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# THE SIXTEENTH YEARBOOK

OF THE

NATIONAL SOCIETY FOR THE STUDY  
OF EDUCATION

PART II

THE EFFICIENCY OF COLLEGE STUDENTS  
AS CONDITIONED BY  
AGE AT ENTRANCE AND SIZE OF HIGH SCHOOL



PUBLIC SCHOOL PUBLISHING COMPANY  
BLOOMINGTON, ILLINOIS  
1917

THE PUBLIC SCHOOL PUBLISHING CO.  
BLOOMINGTON, ILLINOIS

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AGENTS

THE BAKER & TAYLOR COMPANY  
NEW YORK

CAMBRIDGE UNIVERSITY PRESS  
LONDON AND EDINBURGH

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## PART II

THE EFFICIENCY OF COLLEGE STUDENTS  
AS CONDITIONED BY  
AGE AT ENTRANCE AND SIZE OF HIGH SCHOOL

BY

BENJAMIN FLOYD PITTENGER, PH.D.  
*University of Texas*

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*Edited by GUY M. WHIPPLE, Secretary*

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PUBLIC SCHOOL PUBLISHING COMPANY  
BLOOMINGTON, ILLINOIS

1917

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Published August, 1917



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## EDITOR'S PREFACE

The study presented herewith by Mr. Pittenger, of the University of Texas, was carried on by him while he was a member of the instructional staff of the University of Minnesota and has been accepted as a thesis for the doctorate degree at the University of Chicago.

The problem is one of both academic and practical interest: is the quality of work done by the young men and women who enter our colleges affected by the age at which they enter or by the size of the high school from which they come?

Our readers will find the problem set forth clearly in the introductory chapter and a summary of the conclusions in the last chapter. The detailed presentation of the method of study and of the materials on which the conclusions are based will be found in the intervening chapters.

G. M. W.

## AUTHOR'S PREFACE

In the chapters which follow, and which report the results of a statistical study of some problems connected with high-school and college administration, the writer has tried to meet the demands of two very different classes of educational workers. On the one hand are high-school and college instructors and administrators, whose interests are centered in practical results. On the other hand are educational investigators, who are interested in the accumulation of a comprehensive and well-organized body of reliable information, and who will properly insist upon a detailed presentation of all of the data and methods underlying the conclusions reached.

The writer's obligations are many. He is indebted to the managers of the research fund of the University of Minnesota for financial assistance in securing the scholarship records of the college students surveyed. Dr. George F. James, former dean of the College of Education of the University of Minnesota, gave much encouragement and assistance in the initial stages of the enterprise. Director Charles H. Judd and Dr. H. O. Rugg, of the School of Education of the University of Chicago, have contributed the most careful criticism and have assisted in preparing the manuscript for the press. Finally, the writer would express his particular obligations to the superintendents and principals of high schools in Minnesota and adjoining states, whose laborious transcription of the high-school records of thousands of pupils was indispensable to the successful consummation of the work.

B. F. P.

# THE EFFICIENCY OF COLLEGE STUDENTS AS CONDIT- TIONED BY AGE AT ENTRANCE AND SIZE OF HIGH SCHOOL

## INTRODUCTION

### STATEMENT OF PROBLEMS

This study seeks mainly to evaluate two factors in the efficiency shown as students in the College of Science, Literature, and the Arts at the University of Minnesota, by 828 graduates of that university's tributary high schools. The factors considered are the ages at which these pupils entered upon their college work, and the size and general characteristics of the high schools from which they came. The principal problems are as follows:

1. What entrance ages were correlated with the highest degree of college efficiency? How may these correlations be explained?
2. To what extent did the scholarship records of the college students show correlation with the number of pupils enrolled, and with the number of pupils per teacher, in the high schools from which they came? How can one best explain these relations?

The writer would acknowledge at the outset that the factors, the influence of which upon college efficiency he seeks to discover, are very broad and complex. Today, for instance, there is a tendency to substitute the study of physiological for that of chronological age, *i. e.*, actual bodily maturity for ages in years and months; at least to emphasize the fact that chronological age is a very imperfect index of physical and mental maturity. To this tendency the study of chronological entrance ages in the present investigation is apparently opposed. But a review of the studies thus far made upon the relations obtaining between chronological and anatomical ages shows them, as at present defined, to be practically coincident after the chronological age of seventeen.<sup>1</sup> As

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<sup>1</sup>See Chapter II, Section 2.

almost all college students enter at seventeen or later the issue raised is not important. Furthermore, as the study proceeds, it will appear that other causes than differences in maturity are adduced to account for the phenomena discovered.

As to the second factor, it is probable that the size of a high school exercises only an indirect influence upon the college efficiency of its graduates, through other more vital factors which are correlated with it. The size is but the sign of their presence or absence. A large school, for instance, is generally better equipped than a small school, and usually employs teachers with broader training and experience.<sup>2</sup> Both of these facts, and probably others, should make for the higher efficiency of its graduates in college. On the other hand the small school is usually characterized by smaller classes,<sup>3</sup> and thus affords better opportunity for individual attention. Enough has been said to establish the rather obvious point that the phrase "size of high school" is a blanket expression; that size in itself is not effective, but that it is significant because of other factors which are connected with it.

From this point of view an intensive study of the relation existent between the size of a high school and the college efficiency of its graduates looks like wasted effort. But to the school and college administrator, size is a criterion easy to ascertain, and if a consistent relation between these variables can be established, the results promise to serve administrative, if not scientific ends.

Two measures of college efficiency are utilized in this investigation; first, comparative rank in scholarship as indicated by the marks received; and second, the length of time spent in college work. An efficient student is one who does good work, and who remains to complete his college course. In fact, scholarship and retention are regarded, not merely as criteria of college efficiency, but as constituting that efficiency in the meaning of the present study. Efficiency is synonymous with good scholarship and with persistency to the end. By taking this position, the author proposes to avoid an unprofitable and vexatious discussion of the

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<sup>2</sup>Coffman, L. D. *The Social Composition of the Teaching Population.*

<sup>3</sup>Judd, C. H., and Counts, G. S. Study of the Colleges and High Schools of the North Central Association. *Bull. Bureau of Education, 1915, No. 6.*



ultimate significance of both criteria, particularly of school and college scholarship marks.

Through its measurement of efficiency in terms of marks and retention this investigation is allied with two rather extensive groups of previous studies. The first group comprises the numerous investigations based upon school and college marks; the second, the equally numerous investigations of elimination and retention. Perusal of the many papers dealing with these subjects, particularly those based upon school marks, reveals a grave need for a summary of the methods pursued, looking toward careful criticism and ultimate standardization. The reader becomes amazed at the great variety of methods used to achieve very similar ends, and at the even greater differences in reliability which these methods display. Probably no absolute standardization of method is either possible or desirable. Doubtless capable students will continue to differ as to the virtues of certain forms of procedure. But the evidences of grossly amateurish investigation ought to disappear; the conclusions which have followed from hasty labor should be pointed out, and no small part of the work which has been performed probably will have to be repeated. Preliminary to that process we must, so far as possible, standardize our methods.

With some diffidence the writer presumes to offer a summary of the methods heretofore employed in studies of marks and to point out what appear to be the more obvious types of error, with suggestions for their correction. The first chapter of the monograph is devoted to this purpose.



## CHAPTER I

### METHODS PURSUED IN EARLIER STUDIES BASED UPON SCHOOL AND COLLEGE MARKS

A review of the methods pursued in the various studies of school and college marks necessitates a classification of these studies according to the nature of the problems which they attack. From this point of view they fall readily into three fairly distinct classes, which may be described as (1) studies of distribution, (2) studies of continuity, and (3) studies of comparison. In some investigations more than one of these types of problem may appear, but none has been observed which introduced marking problems of a different sort.

#### SECTION 1

##### STUDIES OF DISTRIBUTION

*Definition.* Under this title may be included those studies which have sought chiefly to determine whether or not the curve representing the distribution of scholarship marks follows the form of the binomial or normal curve that presumably represents the distribution of biological traits generally. As a rule, these studies have been conducted by persons interested in defending or opposing the theory that pupils should be graded in their school achievement according to their rank among their classmates, rather than by comparison with some intangible standard of ideal accomplishment. With the recent development of objective scales for the measurement of efficiency in school subjects, the necessity for arguments and studies of this character has considerably declined. For this reason, and because these studies have little bearing upon our own set of problems, our summary of methods in this field is very brief.<sup>1</sup>

*Methods.* The methods which have generally been pursued in studies of this character comprise three steps.

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<sup>1</sup>For a review of results of studies of distribution see Rugg, H. O., Teachers' marks and marking systems. *Educational Administration and Supervision*, Vol. I, 117-142. Also Pittenger, B. F., Scientific studies of the marking system, *American Schoolmaster*, April, 1915, 145-157.

1. Where schools with different marking scales are included in one study, these different scales usually must be reduced to comparable units. Those ordinarily met with are the percentage and the letter scales. In the reduction of these to comparable bases the following points must be kept in mind:

(a) The letter scale may be converted into a percentage scale by properly weighting each of its component divisions. Similarly, the percentage scale may be changed into a letter scale by representing certain ranges of percentage marks by letter units.

(b) Where scales with different passing marks are embraced in one study some readjustment may be necessary. Few, if any, more students are failed in schools with a passing mark of 70 than in schools with a passing mark of 60. Consequently, the marks of such schools can be regarded as comparable only when those of the schools possessing the lower passing marks have been properly weighted. One method which has been used for this purpose is to weight marks of the schools with the lower passing marks, by adding to each an amount equal to the difference between the median marks of each type of school.<sup>2</sup>

2. The second step consists in collecting the marks into unit groups. The nature of these groups depends upon the marking scale involved, as well as upon the nature of the problem. Where the letter scale is used the method is usually the simple one of determining the number of pupils to whom each letter has been assigned. Where the percentage scale is employed the marks may be collected into percentile groups, or into groups of five or tens. The first is the more common mode in studies of this kind.

3. The third step consists in plotting a curve to represent the form of the distribution. Here distances on the abscissa represent the marking units, with the higher units usually toward the right-hand side of the graph. This direction has been reversed by a few students. Distances on the ordinate represent the number of cases comprised within each marking unit.

The majority of distribution studies are complete at this point, or after comparison of the actual distribution with the theoretical

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<sup>2</sup>Starch, D. and Elliott, E. C. Reliability of grading in mathematics. *School Review*, Vol. 21, 254-259.

curve. But a few studies, possessing peculiar aims, have gone further in their analysis. The methods in these cases are usually appropriate only to the special problems raised. Those which are capable of extended application are described in the sections which follow.

## SECTION 2

### STUDIES OF CONTINUITY

*Definition.* Under this head are to be grouped all of those studies which aim principally to compare the school efficiency of a pupil or a group of pupils in one school subject or at one stage of schooling with the efficiency of the same pupil or group of pupils in another subject or at another stage of schooling. The essential thing is that the same students' records are compared, not those of different students.

Two general types of continuity studies are to be recognized. The first is concerned with the maintenance of scholarship rank in passing from the elementary to the high school or from the high school to the college, and from one to another of the succeeding school and college years. The second has reference to the correlation of abilities manifested by the same pupils in different school subjects.<sup>3</sup>

*Methods.* We may note the following steps in the procedure:

1. The first step raises the question of the proper quantity of materials upon which such a study should be based. Two practices are noteworthy. The majority of investigators have sought for large quantities of marks, trusting to numbers to equalize errors due to differences in the conditions under which these marks were received.<sup>4</sup> A few, however, have stressed the point of similarity of conditions, and have held that a limited number of cases for which such similarity can be proved is preferable to a larger number regarding whom these facts are not definitely known.<sup>5</sup> Both types

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<sup>3</sup>For a review of results of continuity studies, see Pittenger, B. F. Studies based upon school and college marks. *American Schoolmaster*: May, 1915, 207-219.

<sup>4</sup>See, for instance, Dearborn, W. F. *Relative Standing of Pupils in the High School and University*. Bulletin, University of Wisconsin, No. 312.

<sup>5</sup>Frailey, J. E., and Crain, C. M. Correlations of excellence in different school subjects. *Journal of Educational Psychology*, Vol. 5, 141-154.

of study are valuable, and if their results coincide, the validity of their combined conclusions seems reasonably assured.

2. The problem of the subject-unit versus the hour-unit may next be raised. Shall a mark in one subject be regarded as equal in value to the same mark in any other subject, regardless of the number of hours per week devoted to each? Or shall the mark in each subject be weighted according to the number of hours involved? Only one study has been noted in which this problem has been definitely raised and the latter procedure adopted.<sup>6</sup> Doubtless, the prevailing practice is more or less warranted by the fact that in the great majority of courses the number of hours involved is identical, and by the principle that subjects with more than the usual number of hours in general compensate for those with less. However, the problem here designated should be kept in mind, and the probable extent of the error involved should always be estimated.

3. In the third place, care should always be exercised that the cases chosen are representative, and are not so selected as to invalidate the conclusions based upon them.

4. Too many of the earlier studies of school marks have failed to take account of the sexes of the pupils involved. With the onset of adolescence, and even before, sex differences become so marked that there would seem to be no excuse for this neglect. It may be advanced as a general principle that the sex factor should be considered in every study dealing with school marks, no matter what the ages of the pupils, unless there is preliminary evidence to show that it is of no importance. We have no mere "pupils" in our schools; each is either male or female.

5. Some studies have been based upon typical marks only, rather than upon all of the marks earned by the pupils concerned. Among these typical marks are failures, promotions, and honors. Where such marks are sufficient to answer the questions raised, their use is a means of great simplification, but it is doubtful whether in general they are completely satisfactory indices of a pupil's work.

6. When the foregoing questions have been disposed of, it

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<sup>6</sup>Jones, A. L. Entrance examinations and college records. *Educational Review*, Vol. 48, 109-122.

usually becomes necessary to reduce the marks to comparable numerical form. Here the procedure described in Step 1 of Section 1 may be followed, or, as is more common, the units of a letter scale may be given values other than percentage equivalents.<sup>7</sup> It should be repeated that in studies of continuity we are concerned with comparing two series of marks earned by the same group of students. Thus, it is clear that while the marks in each series should be reduced to the same terms, it is not necessary that both series be alike if the ranking method of comparison (see Step 7a) be adopted.<sup>8</sup>

We now come to a parting of the ways. Two general methods for ascertaining the degree of continuity between the two series now present themselves. One is by comparison of absolute marks; the other is by means of relative ranks. Methods differ radically in the two cases.

7. Step 7 is the final step in determining degree of continuity if one follows the method of comparing the totals of absolute marks. Three forms of this method appear in the studies reviewed.

(a). Morgan<sup>9</sup> comments upon the value of "conditional promotions" in the University of Chicago High School, by comparing the total percents earned by a group of conditioned pupils during a given term, with the total percents earned by the same group during the term following their conditioned promotion.

(b). Gray<sup>10</sup> compares the efficiency of pupils in certain school subjects from year to year by finding the differences between the percentage marks received by each pupil each year, and then totaling and averaging these differences.

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<sup>7</sup>Here the greatest variety prevails. One approach to a scientific method for finding substitutional values has been worked out by Burris, W. P. *Correlations of abilities involved in secondary school work. Columbia University Contributions to Philosophy, Psychology and Education*, Vol. 9, No. 2, pp. 16-28. For the best work of this sort to date, see Kelley, T. L. *Educational Guidance. Columbia University Contributions to Education. No. 71, pp. 86-92.*

<sup>8</sup>To illustrate the comparison of two ranked series which are based respectively upon two entirely different marking systems, see Thorndike, E. L. An empirical study of college-entrance examinations. *Science*, N. S., Vol. 23, 839-845.

<sup>9</sup>Morgan, W. P. Conditional promotions in the University High School. *School Review*, Vol. 19, 238-247.

<sup>10</sup>Gray, C. T. Variations in the Grades of High-School Pupils. *Educational Psychology Monographs. No. 8, Baltimore, 1913.*

8. Step 8 completely displaces Step 7 in studies of another character, which seek to determine continuity by means of ranks rather than by absolute marks. Here the students are ranked according to the scholarship merit displayed individually in each of two subjects or stages, with or without reducing the marks to comparable bases as described in Step 3. Where the ranking is based directly upon the marks of individual teachers or individual schools, this reduction is unnecessary, and Step 8 replaces Step 3 also. The following modes of ranking appear in the studies reviewed:

(a). Ranking according to marks received in each separate recitation group under the same teacher. This method is undoubtedly the best in most cases where the original marks are in the form of percents, as it avoids errors arising from combining the marks given by different teachers.<sup>11</sup> Where the letter scale is used, however, and where only one mark appears for each pupil, too many pupils must ordinarily be assigned the same rank. This is particularly disastrous when the tertile, quartile, or quintile grouping is to follow. In such a case, actual trial has shown that more than three-fourths of the students will be assigned to their quartile, or quintile positions largely by chance.

(b). Ranking based upon accumulated marks. Here all of the marks given to a pupil by different teachers are brought together before the ranking takes place. Ranks may then be based upon (1) a comparison of the total values of the percents or letter-equivalents,<sup>12</sup> or (2) a comparison of their average values. The latter method is by far the more common one.

Where pupils from two or more elementary schools have been studied for their high-school continuity in scholar ship rank, or pupils from two or more high schools for college continuity, in most cases (1) the students have been ranked in each school separately, but in some cases (2) all of the students have been thrown together before the ranking has been made, irrespective of differences in the marking standards prevailing in the different schools.<sup>13</sup> It seems

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<sup>11</sup>Gray, C. T.: op. cit. See also Starch, D. Correlations among abilities in school subjects. *Journal of Educational Psychology*, Vol. 4, 415-418.

<sup>12</sup>Thorndike, E. L., op. cit.

<sup>13</sup>See Shallies, G. W. Distribution of high-school graduates after leaving school. *School Review*, Vol. 21, 81-91.



needless to say that only the former of these last two methods is permissible.

The weakness of the method of ranking according to accumulated marks is that it assumes that a mark given by one teacher is equivalent to a mark of the same denomination given by any other teacher. This assumption is not valid. Some teachers consistently mark much higher than others, so that the 70 of one teacher may be as good as the 85 of another. However, where the study involves enough cases these errors will possibly balance each other. But in a study involving a few cases the method described in the preceding section should be adopted, and the marks of the different teachers should be so weighted as to be made comparable.

9. When a group of students has been ranked in order of merit from poorest to best according to the quality of work done by them at one stage of their course or in one school subject, and has also been ranked according to the efficiency shown at another stage or in another subject, the type of study with which we are now dealing seeks to determine the degree of continuity obtaining between these two rankings. Does a student who ranks high in the first series also rank high in the second series, and *vice versa*? The following methods have been pursued in attempting to answer this question:

(a). The plus (+) and minus (—) median method.<sup>14</sup> In this method the investigator finds the number of those ranking above or below the median in the first series, who continue to rank above or below the median in the second series.

(b). The modified-median<sup>15</sup> or tertile-median<sup>16</sup> method. Here the investigator finds the proportion of those students ranking in the highest tertile in the first series who rank above the median in the second series. The continuity between the lowest third and lower half is similarly ascertained.

(c). Coefficients of correlation. The coefficients which have

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<sup>14</sup>Dearborn, W. F. Qualitative elimination from school. *Elementary School Teacher*, Vol. 10, 1-13.

<sup>15</sup>Clement, J. A. *Standardization of the Schools of Kansas*. University of Chicago Press, 1912.

<sup>16</sup>Dearborn, W. F. Practical results of recent studies in educational statistics. *School Review*, Vol. 21, 297-306.

been chiefly used for the determination of positional continuity are the Pearson "product-moments" and the Spearman "rank-difference" methods. It is not our purpose in this connection to describe and explain in full these methods. They are implements of general statistics, which have been borrowed from that larger field by educational statisticians, and have been described already in many places.<sup>17</sup>

However, the writer is persuaded that there has existed a tendency to resort to these highly specialized measures when simpler measures would better serve the purpose. Where a simple quantitative statement of the probable general relationship existing between two series of variables is all that is demanded, the correlation coefficients will often serve admirably. But where more than this is wanted they are useless, for they can give no more. They do not generally indicate relations obtaining between particular portions of the two series of variables, nor do they reveal the peculiarities of form which either series may possess. In a field of research so immediately practical as educational research may and should be, these relations and forms are often more important than the general relations, so that the inadequacy mentioned becomes serious.

(d). Method of tertile, quartile, or quintile continuity. In this method each of the two ranked series is divided into three, four or five equal numerical parts by beginning at the upper end of each series and counting downward. The students occupying each position in the first series are then traced to their respective positions in the second series, and their positional continuity determined. Various methods of stating this continuity have been devised.

(1). Simple statement of the percentages of the students occupying the low, middle, and high groups in the first series who are found in each group in the second series.<sup>18</sup>

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<sup>17</sup>Whipple, G. M. *Manual of Physical and Mental Tests*. Warwick and York, Second Edition, 1915, Part I.

<sup>18</sup>Clement, J. A. Op. cit.

(2). Method of "gains and losses." This method was devised by Gray, and corresponds to the same author's method of gains and losses in the use of percentage marks described above. It consists in finding the algebraic sum of the quintile variations undergone by the different pupils in passing upward from grade to grade. The same principle is applicable in estimating the amount of tertile or quartile variation. It was applied to the study of tertile variation in the recent Cleveland survey.

(3). Graphic representation. Different forms of graphic representation have been proposed by Clement<sup>19</sup> and Carter.<sup>20</sup> As both of these sources are readily accessible, it seems unnecessary to reproduce their methods here.

(c). Kelly<sup>21</sup> has pointed out a rather obvious defect of the tertile, quartile, or quintile method of correlation, and has proposed a means of avoiding this defect which can be applied to continuity studies. The defect is described thus: "When a distribution, say of fifty marks, is divided into quintiles, the tenth mark needs to change but one rank in order to fall into the next quintile, and thus register one quintile change. The first individual in the distribution, on the other hand, has to change by as much as ten ranks in order to register one quintile change."

He describes his means of avoiding the defect as follows:

"If we record in the left-hand column of the accompanying table the ranks of the boys in their own high-school group, and in the second column their ranking in the freshman college group, we may count the quintile gains or losses by subtracting each rank from the corresponding rank in the other series. If this difference equals one-fifth of the total number of ranks in the series, it will register as one quintile change. If it equals two fifths of the number of ranks in the series it will register as two quintile changes, etc. For example, in the table given herewith, from fourth to eighteenth rank is a change of fourteen places and we register a loss of one quintile. From tenth to forty-ninth place is a drop of three quintiles, etc."

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<sup>19</sup>See Clement, J. A. Op. cit.

<sup>20</sup>Carter, R. E. Correlation of elementary and high schools. *Elementary School Teacher*, Vol. 12, 109-118.

<sup>21</sup>Kelly, F. J. *Teachers' Marks*. Teachers' College Contributions to Educ. No. 66, 1914.

KELLY'S TABLE.

HIGH-SCHOOL RANKS.	FRESHMAN COLLEGE RANKS.	QUINTILE GAINS OR LOSSES.
1	3	0
2	5	0
3	2	0
4	18	-1
5	8	0
6	19	-1
7	7	0
8	14	0
9	9	0
10	49	-3
11	17	0
12	6	0
42	38	0
43	13	3
44	22	2
45	25	2
46	21	0
47	42	0
48	23	2
49	34	1
50	48	0

The point which Kelly makes is undeniably valid, and the substitute method is useful in certain types of continuity studies. But in the present writer's opinion Kelly has over-stressed both the importance of his criticism and the value of his substitute method. The criticism which he advances may be made with equal propriety upon every marking system now in use, in that all of them involve a series of discrete units. That is to say, the different units in any marking system, however numerous, are sharply separated each from each, like steps in a stair, while the variations in scholarship represented by these marks are continuous, and in a large group ranked in serial order may be practically infinitesimal. Some students are clearly A students; others are less clearly A students; yet both will be marked A. The only marking system which even nominally avoids this difficulty is the percentile system, because of its more numerous and consequently finer discriminations: yet it is very doubtful whether these finer distinctions are anything more than artificial. Furthermore, the final step in Kelly's method also involves a discrete series, and introduces again the very type of error that it is designed to avoid. Finally, it is a method that can-

not be applied in any way to studies of comparison, because in these studies the different ranked series comprise different groups of students.

In the methods which we have described we have noted the division of the ranked series into halves, tertiles, quartiles, and quintiles. There is evidence of a growing preference for the tertile or quintile divisions, because an even division into either halves or quartiles splits the mediocre group in two, while the odd divisions leave this middle group intact and differentiate those students who rise above or fall below mediocrity. Of the two odd divisions the quintile is increasing in use, probably because of the finer distinctions of which the more numerous divisions permit.

### SECTION 3

#### STUDIES OF COMPARISON

*Definition.* Under the head of comparative studies we include those whose principal aim has been to compare the attainments of different groups of pupils as evidenced by their school marks. The significant feature here is the comparison of the records of one group of students with those of another group, rather than to compare the same group's records made under different circumstances, as in the continuity studies. No uniform methodology has been worked out for studies of comparison, and considerable variation appears in consequence. The following paragraphs record only the most common methods.

*Methods.* Steps 1 to 6 in methods of comparison may be borrowed directly from the corresponding steps described under methods of continuity.

7. Comparisons may be based directly upon accumulated marks. Where this method is used, it is necessary to put into comparable form marks earned by each of the groups of students whose efficiency is to be compared. For this purpose one may adopt any of the following devices:

(a) Total the marks of each denomination, or their numerical equivalents. That is to say, bring together all of the A's, B's, or other marks earned by each group of students to be compared. Here, again, one encounters the problem of the different marking stand-

ards held by different teachers, and the warnings given above must be respected.

(b) If the differences between the groups that are to be compared are pronounced, and if no precise statement of the amount of these differences is desired, one may next simply plot curves to show the distribution of marks in each of the student groups.<sup>22</sup> Directions for plotting these curves have already been given in Step 3 of Section 1.

(c) If, however, the investigator wishes to make a precise statement of the amounts of the differences obtaining between the various student groups, another method must be adopted. Here may be used any of the established statistical modes of stating central tendencies and variations. These methods have already been described and discussed too widely to need extensive treatment in this place.

(8). Step 8 should be entirely substituted for Step 7 when the ranking plan is to be used for purposes of comparison. This plan should generally be substituted for the simpler one based upon absolute marks, when schools with different marking systems are involved in the same study. The methods to be pursued in the ranking process are similar to those described in Step 8 of Section 2. It has been customary to follow this ranking by a division of each ranked series into tertiles, for each comparative group and in each school, as in the studies of continuity.<sup>23</sup> The tertile positions of the different members of each comparative group may then be assembled, and rough comparisons made upon the basis of these totals. No precise method for stating this comparison has yet been devised.

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<sup>22</sup>Johnson, F. W. A study of high-school grades. *School Review*, Vol. 19, 13-24.

<sup>23</sup>See Shallies, G. W. Op. cit.; Mitchell, H. E. Distribution of high-school graduates in Iowa. *School Review*, Vol. 22, 82-91. Pittenger, B. F. Distribution of high-school graduates in five North Central states. *School and Society*, Vol. 3, 901-907.

## CHAPTER II

### RESULTS OF EARLIER STUDIES CONCERNED WITH AGE AT ENTRANCE AND WITH SIZE OF HIGH SCHOOL

In the foregoing chapter the writer has attempted to arrange and criticize the various methods used in earlier studies dealing with school and college marks. Such a critique is necessary, since we propose to utilize similar materials. But there is another group of studies which demands consideration here because, while based upon different materials, it is directed toward problems similar to those raised in this investigation. However, it is the results and not the methods of these studies which are of interest at this point.

#### SECTION 1

##### STUDIES CONCERNED WITH AGE AT ENTRANCE INTO THE ELEMENTARY SCHOOL

One of the first books bearing even indirectly upon this question was published by C. H. Keyes<sup>1</sup> in 1911. Keyes studied the influence of several different factors, one of which was age at entrance, upon the rate and consistency of progress through the grades. The question of efficiency as displayed by marks or other qualitative symbols was not raised. The influence exerted by age at entrance upon grade progress is shown in the following quotations:

“Practically all children who begin the first grade after reaching their seventh birthday, or before reaching their fifth, may be expected to lose a year during some part of their grammar-school course.”

“Of all who enter the first grade under five years of age only one in nine gains a grade during the course. Of those who enter during their fifth year, one in four makes such a gain; while more than one in every three who enter after reaching their sixth birthday gain a year at some time during the course.” But “this does not mean that there is no gain in starting children to school at an early age if they are psychologically fit,” inasmuch as “60 percent of the early entrants preserve the advantage of the year over the average child.” The loss found among the early entrants is thus assumed to be due to the presence of undeveloped children.

<sup>1</sup>Keyes, C. H. *Progress through the Grades of City Schools*. Teachers College Contributions to Education. No. 42. N. Y., 1911.

“Arrest is most likely to follow too early or too late entrance to school. Fifty percent of all children who enter grade one before the age of five years meet arrest at some place in the course; likewise 46 percent of those entering between seven and seven and one-half years, and 49 percent of all entrants over seven and one-half years, become arrests.”

The general outcome of this investigation is to establish six and seven as the best ages for entrance into elementary school, with distinct preference for the age of six.

The second investigation of this character<sup>2</sup> was published by W. H. Winch, in 1911. Winch's study was conducted in the elementary schools of England where entrance conditions are very different from those in America; but, because it deals with earlier ages than are comprised in the American studies, it may be reviewed with some care.

In England, children may enter school at three years of age, and must enter at five. While some enter a few months after five, the great majority of entries are distributed indiscriminately between these ages. Winch sought to discover the correlation between different portions of this two-year entrance period, and school efficiency.

Two measures of school efficiency were adopted; one called the “progress mark,” and the other a scholarship mark based upon the Head-Master's examinations in the later “Standards” (grades). The second of these criteria is easily comprehended, but the first requires some explanation. The grades of the English elementary school range from Standard I to Standard VII, being preceded generally by a short term in the infant school. It is age of entrance in the infant school with which Winch is concerned. The accepted age for beginning Standard I is 6 years and 6 months, and for beginning Standard VII is 12 years and 6 months. Many students are two years behind this program in the latter end of this course, and but few are slower than that; “so,” says Winch, “I took the pupil who was two years behind as being credited with 0 progress marks, and those who were more than two years behind received a negative mark. The ages of the children were calculated in months, so that a boy two years and one month behind would receive a negative mark of one. If he were one year and eleven months behind he

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<sup>2</sup>Winch, W. H. *When Should a Child Enter School?* Baltimore, 1911.



would, of course, receive a positive mark of one; if he were just right his mark would be 24; and if he were one year ahead of the normal age . . . he would receive a positive mark of 36." Hence "we have merely to take the age in years and months when he entered his present standard, and add to, or subtract from 24, the months by which he is in advance of, or behind the normal age" (pp. 10-11).

"If now we collect the progress marks of all children who entered between 3 and 3½ years of age, and of all those who entered between 3½ and 4 years, and so on, we ought to see at a glance whether there is any marked correlation between age of entry and subsequent progress in school." Two sample tables from Winch's results are given herewith.

## SCHOOL "G"—BOYS

Age of Entry	Number Pupils	Av. Prog. Mark per Pupil	Av. Exam. Mark (Max. 10)	Pearson Coefficient (Age with Prog.)	Probable Error
3-3½	12	20.6	7.5	-.1727	.09
3½-4	7	19.4	7.2		
4-4½	8	21.6	7.9		
4½-5	16	19.0	7.9		
5-5½	12	15.4	7.7		
5½-6	2	17.0	..		

## SCHOOL "G"—GIRLS

3-3½	7	19.0	7.9	-.0116	.08
3½-4	4	20.7	8.2		
4-4½	15	20.8	7.0		
4½-5	10	20.5	7.8		
5-5½	25	19.3	8.2		
5½-6	..	..	..		

Tables corresponding to these two, and displaying very similar tendencies, are presented for eight boys' schools and three girls' schools, after which the author writes:

"I think we may fairly conclude that, so far as intellectual results are concerned, and in so far as these are measured by school progress, we can claim no advantage for early entry into school; that is, children who enter at three years of age progress neither more rapidly nor more decisively than those who enter at five. I do not consider that the evidence is satisfactory for entrance ages beyond five years, as the numbers are small. . . I conclude, however, with confidence that, as far as subsequent school progress is concerned, it is of trifling importance, if not absolutely unimportant, whether a child begins school at three or at five years of age" (p. 38).

The other significant conclusions reached after an elaborate analysis, are:

(1) "That children who come from very poor homes, that is, from homes in which there is no adequate supervision for the young child, are smaller in number than is generally supposed; and that even under present conditions, such children commence to attend school not at one special age, but fairly evenly, in the same proportions as other children, between the ages of three to five and one-half years. But not quite evenly: there is some positive correlation between poor homes and early entry." (2) "No advantage appears to exist in early entry so far as the subsequent attainment of good behavior and the development of attentiveness are concerned."

The conclusions of this rather extensive and elaborate investigation are thus chiefly negative in character: the chief point of a positive nature is that children who enter school much before five afterward lose sufficient time so that they arrive at the end of their course at practically the same age as the five-year-old entrants.

The third paper of the series now under discussion was brought out by Ayres,<sup>3</sup> in 1912. Three separate studies are combined in this report, from which we will quote what bears on our problem.

"In 1908, the writer conducted an investigation for the Board of Education of New York City, in which a study was made of . . . a group of 257 pupils in the eight grades, who were about to graduate, and whose entire school histories from the date of first entering were intact and available. The number of children in each entering age-group and the time taken to complete the course were as follows:—

Age at Entrance	Number of Children	Average Years to Complete Eight Grades
5.....	64.....	8.9
6.....	113.....	8.6
7.....	54.....	8.4
8.....	19.....	8.2
9.....	7.....	7.2

"The figures show a steady but slight falling off in the amount of time required by the children of each advancing age-group to complete the course. This decrease is so small that it lends no support whatever to the prevalent opinion that the child entering school late will make such rapid progress as easily to catch up with the children who entered two or three years earlier."

The second of Ayres' studies was also made with New York City children, comprising 11,185 cases, in 1909. The tabulated data for these children follow:

<sup>3</sup>Ayres, L. P. *The Relation Between Entering Age and Subsequent Progress Among School Children*. Bulletin No. 112, Division of Education, Russell Sage Foundation, 1912.

Age at Entrance	Number of Children	Median Years to Complete Eight Grades
5.....	1521.....	8.2
6.....	5828.....	8.1
7.....	2936.....	8.0
8.....	721.....	7.9
9.....	142.....	7.4
10.....	26.....	6.9
11.....	9.....	6.6
12.....	2.....	6.3

“These figures again expose the fallacy of the common assertion that the child entering late easily catches up with the one who begins early.”

The third set of data is still more significant. This material was collected through the Division of Education of the Russell Sage Foundation, and comprised 13,867 cases, from the schools of 29 cities. The tabulated data follow:

Age at Entrance	Number of Children	Median Years to Complete Eight Grades
5.....	2663.....	8.7
6.....	6050.....	8.5
7.....	3653.....	8.2
8.....	1151.....	7.8
9.....	255.....	7.2
10.....	58.....	6.3
11.....	22.....	
12.....	9.....	
13.....	3.....	
14.....	4.....	

“These figures closely resemble the two foregoing series. They show that the children who enter school at advanced ages gain a little on those who enter early, and that this gain becomes greater as the upper ages are reached. They again show that this gain is not enough to enable the late entering child to catch up with the one who enters early.”

After this discussion, the author proceeds to select the most auspicious entrance age. With the group of records from the 29 cities, “a division into three progress groups was made in which those pupils who had taken more than eight years to complete the eight grades were designated as slow, those who had taken just eight years as normal, and those getting through in less than eight years were termed rapid. The children of each entering age were divided among these three progress groups as follows:

Age at Entrance	Percent Rapid	Percent Normal	Percent Slow
5.....	10.....	58.....	32
6.....	27.....	52.....	21
7.....	40.....	45.....	15
8.....	59.....	33.....	8
9.....	81.....	17.....	2
10.....	98.....	2.....	..
11.....	100.....	.....	..
12.....	100.....	.....	..
13.....	100.....	.....	..
14.....	100.....	.....	..

“Is the best entering age the one which results in the greatest proportion of rapid pupils, the smallest proportion of slow pupils, the largest proportion of normal pupils, or the most equal balance between these three groups? The writer is inclined to the opinion that . . . the best entering age is the one that results in a large proportion of normal pupils, combined with the most equal balance between the rapid and slow groups. In the present case this is the entering age of six.”

This table is checked by comparison with another “which considers a fourteen-year-old child in the eighth grade as of normal age, one younger as below normal age, and one older as above normal age.”

Age at Entrance	Percent Young	Percent Normal	Percent Over-age
5.....	67.....	25.....	8
6.....	27.....	52.....	21
7.....	8.....	33.....	59
8.....	3.....	14.....	83
9.....	2.....	7.....	91
10.....	2.....	10.....	88
11.....	.....	5.....	95
12.....	.....	.....	100
13.....	.....	.....	100
14.....	.....	.....	100

This table resembles the preceding “in that the entering age of six is the one which results in combining the greatest proportion of normal pupils with the most equal balance between the young and over-age groups.” These results are further substantiated by finding that the six-year-old entrants graduate most nearly on normal time, and that this group shows the greatest homogeneity in its progress rate.

Ayres concludes that, using rate of progress through the grades as the criterion, late entrants, while progressing more rapidly than

early entrants, do not generally overtake them; and that "the entrance age of six is the one which makes the best showing with respect to resulting in the largest number of the children finishing the course at normal age," and with respect to furnishing "the most homogeneous group, judged on the basis of subsequent progress."

## SECTION 2

### STUDIES CONCERNED WITH AGE AT ENTRANCE INTO THE HIGH SCHOOL

In a little volume entitled *The High School Age*, Irving King<sup>4</sup> devotes a chapter to the further elaboration of earlier studies made by Van Denburg<sup>5</sup> and Dynes,<sup>6</sup> in so far as they dealt with age at entrance. He seeks first to "gain some idea of the probable ability, at the time of entering high school, of high-school boys and girls as compared with school children in general." The median age of high-school entrance as found by Dynes was 14.9, by Van Denburg 14.5; "that is, one-half of all the pupils studied in these two cities (Iowa City and New York) entered before fifteen." "In Iowa City the children entering the elementary school probably average six years of age. In New York City the average age of entrance is given as seven. If these Iowa City children are regularly promoted they finish the elementary course in eight years, or at the end of the fourteenth year. Similarly, New York City children would normally finish the elementary schools at the end of the fifteenth year. If, then, more than half of those entering the high school enter earlier than the above ages, they have at one or more points in their elementary school work skipped grades or gained special promotions. Every such incident in the life of a child is an indication that he has possessed, at one time or another, more than average ability . . . . Then, while about *one in every twenty-three of elementary-school children* gain special promotions, *one in three of those who come to the high schools* have apparently gained such promotions." The natural conclusion is that high-school entrants are a highly selected group. Confirmation of this inference is found in Dearborn's in-

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<sup>4</sup>King, Irving. *The High School Age*. Bobbs Merrill Co., Indianapolis, 1914.

<sup>5</sup>Van Denberg, J. K. *The Elimination of Pupils in Public Secondary Schools*: Teachers College Contributions to Education, No. 47.

<sup>6</sup>Dynes, J. J. Study unpublished.

vestigation into qualitative elimination in the elementary school.<sup>7</sup>

The second question raised by King is as to the "relation between entering age and the pupil's likelihood of finishing his course." This question is answered in the form of a table.

*Table Showing in Percents the Comparative Graduation Expectancy of the Various Entering ages (After King)*

Ages	Iowa City	New York City
12-13.....	65.....	23.0
13-14.....	50.....	19.0
14-15.....	39.....	10.0
15-16.....	29.....	6.5
16-17.....	17.....	3.5

This table is followed by the remark: "We may say with Van Denburg that, 'as far as age is concerned, thirteen is the ideal age for high school entrance,' or even between twelve and thirteen." It seems unnecessary to elaborate upon the fallacy of this remark, in view of the other conclusion just quoted—that high-school pupils, particularly the early entrants, are a selected group. The table gives an acceptable indication of what happens to those pupils who now enter the high school at twelve or thirteen; but it gives no indication at all of what would occur if all pupils were to enter at those ages.

The third problem raised by King concerns the relation between entering age and subsequent high-school scholarship. This question is answered indirectly, by ascertaining that the graduates, upon the whole, do work which is very superior to that of the non-graduates. When this fact is coupled with the earlier-mentioned fact that there is a high correlation between graduation expectancy and early entrance age, there is inferred a similar correlation between efficiency in scholarship and early entrance age.

We may conclude our summary of King's discussion with the remark that it seems singularly unfortunate that no discrimination between the sexes has been attempted, during this period when sex-differences might be expected to be paramount.

A recent development in discussions relating to the ages of high-

<sup>7</sup>Dearborn, W. F. Qualitative elimination from school. *Elementary School Teacher*, Vol. 10, 1-13.

school (and grammar-school) pupils is to emphasize anatomical or physiological rather than chronological age.<sup>8</sup> "The term anatomical or physiological age refers to the stage of development in contradistinction to chronological age in years and months, which is our usual method of age designation." Various methods of determining physiological age have been adopted; King used the personal judgments of teachers and principals, and Crampton used the appearance of the teeth and the onset of puberty, as shown by menstruation or the appearance of pubic hair. In general, three periods of development are recognized; the pre-pubescent, pubescent, and post-pubescent (Crampton), or the immature, the maturing, and the matured (King). From the records of 4,800 boys in New York City high schools, Crampton finds the relations between anatomical and chronological age shown in the accompanying table.

*Chronological vs. Anatomical Age*

Chronological Age	Anatomical Age		Percent Post-Pubescent
	Percent Pre-Pubescent	Percent Pubescent	
12.5-13	69%	25%	6%
13-13.5	55	26	18
13.5-14	41	28	31
14-14.5	26	28	46
14.5-15	16	24	60
15-15.5	9	20	70
15.5-16	5	10	85
16-16.5	2	4	93
16.5-17	1	4	95
17-17.5	0	2	98
17.5-18	0	0	100

Regarding the peculiarities of these developmental periods, Crampton tells us that "at characteristic ages, the mature are more

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<sup>8</sup>In connection with the topic of physiological age the reader may note the following:

Crampton, C. W. The Influence of physiological age upon scholarship. *Psychological Clinic*, Vol. I, 115-120.

Crampton, C. W. Anatomical or physiological vs. chronological age. *Ped. Sem.*, Vol. 15, 230-237.

Foster, W. L. Physiological age as a basis for the classification of pupils entering high school. *Psychological Clinic*, vol. 4, 85-88.

King, Irving. Physiological age and school standing. *Psychological Clinic*, Vol. 7, 222-229. See also *The High School Age*.

than 33 percent heavier, ten percent taller, and 33 percent stronger than the immature," and that "the immature boys of all ages fail to pass the work of any grade much more than those who are mature." As has been pointed out by Whipple,<sup>9</sup> this last statement is contradicted by Foster, who found that, of 58 failures, 40 were in the most mature groups, while, of 179 promotions, 100 were in the least mature groups. As Whipple says, more investigation of this point is needed.

King offers considerable evidence to show that "children of early or normal development in every case can do better work [in school] than those who are somewhat later, if not retarded, in their development." Crampton states that "a preliminary investigation shows that in the fifth, sixth, and seventh years in the elementary schools in New York City, the poor scholars are on the average of 37, 40, and 46 percent more advanced in maturity than the good scholars," but asserts that "this is quite contrary to the condition shown in high schools." The evidence for the latter part of this statement is not given, but the difference would appear to be correlated with the retention of the over-age and poor pupils in the elementary school, and the promotion of the brighter, but earlier maturing pupils into the high school.

In practically all of the studies quoted above, boys have been the sole objects of attention, owing to the greater difficulty experienced in obtaining reliable data relating to the pubescent development of girls. King's work is an exception.

The full bearing of this matter of maturity of development upon the question of high-school-entrance age is not yet clear. One fact alone stands out; *i. e.*, that these differences in maturity are far more pronounced and important during the freshman year than later, when elimination and increase in age have reduced them. It also seems probable that a large proportion of those who enter the high school at an early age are mature pupils; and that the superior ability which appears to be correlated with this early maturity is in part responsible for the better grades and greater persistency displayed by this group. However, at present we can say with cer-

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<sup>9</sup>Whipple, G. M. *Psychology and Hygiene of Adolescence*, in Monroe's *Principles of Secondary Education*, Macmillan Company, N. Y., 1914. Ch. VII.



tainty that the problems affecting high-school-entrance ages are closely bound up with these problems of comparative development, and that simple chronological age is a very inadequate criterion of readiness to enter the high school.

### SECTION 3

#### STUDIES CONCERNED WITH AGE AT ENTRANCE INTO COLLEGE

No investigations have come to the author's notice which bear directly upon problems of age and college entrance. The nearest approach is in a one-page report by Forsyth<sup>10</sup> of the correlation existing between the ages of college students and their marks. The study included 1,306 men students and 644 women students of the University of Illinois, for the school year 1909-10. The men showed a Pearson coefficient of 0.0938, P. E., 0.0685; and the women a coefficient of 0.1996, P. E., 0.0360. "The results indicate that, on the average, age has a little, but a very little favorable effect on scholarship. . . . Both coefficients, though small, are well beyond the probable error. . . . The coefficient for the women has more than twice the value of the one for the men."

### SECTION 4

#### STUDIES CONCERNED WITH SIZE OF HIGH SCHOOL

Thorndike<sup>11</sup> issued in 1907 the first study dealing with the size of American high schools, as measured by number of teachers employed and pupils enrolled. The data refer to conditions in 1904. The tables herewith are copied or adapted from this report:

*Table Showing Number and Percentage of High Schools Employing Different Numbers of Teachers in 1904. (Adapted from Thorndike)*

No. Teachers	No. Schools	Percentage Schools
1.....	2175.....	30
2.....	1807.....	25
3.....	1221.....	17
4.....	640.....	9
5.....	380.....	5

<sup>10</sup>Forsyth, C. H. Correlation between ages and grades. *Journal of Educational Psychology*, Vol. 3, 164.

<sup>11</sup>Thorndike, E. L. A Neglected Aspect of the American High School. *Educational Review*, Vol. 33, 245-255. See also Strayer and Thorndike, *Educational Administration*, Macmillan, 1913, 165-175.

1-5.....	6223.....	86
6.....	208	
7.....	172	
8.....	87	
9.....	74	
10.....	48	
5-10.....	588.....	8
11-15.....	165.....	2
16-20.....	78	
21-25.....	63	
26-30.....	27	
31-35.....	14	
36-40.....	13	
41-50.....	9.....	4
51-60.....	8	
61-70.....	4	
71-80.....	3	
81-90.....	2	
91-100.....	0	
101-110.....	2	

Table Showing Percentages of High-School Pupils in Different Sized Schools, in 1904. (After Thorndike)

In schools of	1-3 teachers are	36.6% of public high-school pupils
" " "	4-6 " "	22.1 " " "
" " "	7-10 " "	9.1 " " "
" " "	11-20 " "	13.5 " " "
" " "	21-30 " "	7.7 " " "
" " "	31-40 " "	3.6 " " "
" " "	41-50 " "	2.0 " " "
" " "	51-110 " "	4.5 " " "

Thorndike concludes: "The most typical, in the sense of the most frequent, secondary school in the United States is a school taught by one teacher. The secondary schools in the country with only one teacher outnumber by a considerable figure all the rest. Those with one, two, or three teachers are ten times as frequent as those with ten or more teachers and five times as frequent as those with from five up to ten teachers. . . . The frequency of the schools of small teaching force is so much greater that in spite of the large registration of city high schools there are more pupils in the two-teacher high schools than in any other one group . . . and more in schools with three teachers or fewer than in schools of from five to thirteen teachers, and nearly, if not quite, as many as in schools of fifteen or more teachers. These facts show that the high school is . . . an institution of enormous variability as regards its capacity for educational work and its administrative and educational arrangements. This variability has never been fully realized in the discussions of secondary school problems. The recommendations made are often utterly impossible of realization by the village high school and decidedly unwise for the unlimited possibility high school. The rule must in the nature of the case be that what is best for any one-fifth of high-school effort is not the best for any other fifth."

In a study embracing 46 high schools and 36,276 pupils from different parts of the United States, Rounds and Kingsbury<sup>12</sup> have suggested some correlation between the size of school and the quantity of promotions in English and mathematics, as in the following table:

High School Enrolment	Percent passing in	
	English	Mathematics
Less than 400 .....	82.10.....	75.55
From 400 to 800 .....	80.62.....	74.72
More than 800 .....	83.23.....	75.73

These writers find, however, great variation among the school of each of these groups; so great, in fact, that the small differences in central tendencies deserve to be given little weight.

Two intensive analyses of the high school of the North Central Association have recently appeared. The first of these was compiled by Jessup and Coffman,<sup>13</sup> the second by Counts.<sup>14</sup> As the second supersedes the first, and as the methods pursued were very similar, we shall confine our review to the latter. Counts treats the size of 1,000 selected high schools as indicated in two ways; by the number of students enrolled, and by the population of the town in which each school is located. The towns are grouped in seven groups, with the following respective populations: under 2,500; 2,501-5,000; 5,001-7,500; 7,501-10,000; 10,001-15,000; 15,0001-50,000; above 50,000. As to enrolment, the schools are grouped under six heads, as follows: 1-100, 101-200, 201-300, 301-500, 501-1,000, above 1,000.

In the first of the accompanying tables, both of which are compiled from Counts' results, is given a summary of the characteristics found to mark the schools in towns and cities of the different sizes described in terms of the median school of each size. But as Counts wisely observes, the median alone is not entirely trustworthy in describing a large, and particularly a varying group. Consequently,

<sup>12</sup>Rounds, C. R., and Kingsbury, H. B. Do too many students fail? *School Review*, Vol. 21, 585-597.

<sup>13</sup>Jessup, W. A., and Coffman, L. D. *North Central High Schools*. National Society for the Study of Education. Thirteenth Yearbook. P. S. Publishing Company, Bloomington, Ill.

<sup>14</sup>Judd, C. H., and Counts, G. S. Study of the colleges and high schools of the North Central Association. *Bulletin, United States Bureau of Education*, 1915, No. 6.

we shall accompany the table by a brief verbal summary designed to supplement the evidence of the medians. The second table will be similarly supplemented.

*Table Showing Characteristics of High Schools in Cities of Different Populations (After Counts)*

Characteristic of median schools in cities of population of	2,500 or less	2,501- 5,000	5,001- 7,500	7,501- 10,000	10,001- 15,000	15,001- 50,000	50,000 and more
Enrolment.....	126	176	210	273	335	459	742
No. pupils per teacher.....	17	19	20	20	21	21	23
No. teachers per school.....	8	9	11	13	15	22	33
Percent teachers inexperienced...	30.7	30.2	22.2	28.7	19.9	16.9	9.7
Percent new teach- ers untrained...	8.9	7.7	6.8	7.8	7.8	10.1	10.6
Percent old teach- ers untrained...	4.8	7.4	5.2	7.0	4.9	6.1	8.2
Salary, teachers...	\$ 723	\$ 765	\$ 793	\$ 861	\$ 906	\$ 970	\$1381
Salary, prin.....	1058	1140	1292	1445	1587	2005	3014
Salary, supts.....	1628	1750	1950	2000	2290	2700	....
Percent of gradu- ates who enter college.....	22.3	22.3	27.4	29.7	29.8	26.0	36.3
Percent graduates who go into teaching.....	9.1	5.9	3.9	3.4	2.0	2.3	0.6
Percent of total units of work de- voted to English	14.3	14.2	13.6	12.8	12.1	12.0	11.1
Percent to Latin..	11.8	12.7	12.6	11.7	11.4	10.5	9.1
Percent to Mod. Language.....	8.6	9.0	9.3	10.0	9.7	10.2	14.8
Percent to Science	11.7	11.8	12.0	11.6	11.7	11.6	11.5
Percent to Mathematics....	10.8	10.8	10.6	9.9	9.2	8.8	8.6
Percent to Hist., Civics.....	11.6	11.5	11.7	11.3	10.5	10.4	9.3
Percent to Tech. Subjects.....	22.2	23.7	24.5	26.8	29.5	32.1	29.8
Percent to Commerce.....	6.8	8.1	10.0	10.3	10.4	13.9	7.2

This table affords data which bear out the following statements:

1. The number of pupils enrolled in high school increases with the increase in city population, "but it is an interesting fact . . . that, while the large schools are with hardly an exception, found in the larger cities, the small schools are by no means confined to the small cities. The range of variation in size of schools increases with the size of the cities" (p. 39).

2. The number of teachers per school does not increase proportionally to the increase in enrolment. Consequently, the ratio of pupils to teachers is higher in the larger than in the smaller towns.

3. Schools in smaller towns and cities are forced to accept an undue proportion of inexperienced teachers.

4. The salaries paid to teachers in cities of different sizes seem to parallel in amount the experience of the teachers and the number of pupils whom they must supervise.

5. "The salaries of principals increase with the increase in the size of cities much more rapidly than do the salaries of teachers; and the salaries of superintendents increase in about the same fashion as the salaries of principals. These facts would indicate that the need for efficient administrators and supervisors becomes increasingly apparent as the cities increase in size, while there is no corresponding change in the demands upon classroom teachers."

6. The larger the city, the larger the proportion of its high-school graduates who enter colleges and normal schools, or who take up business pursuits, professional preparation, or the trades; and the smaller the proportion who enter commercial schools, immediate teaching, farming, and other callings.

7. The larger the city, in general, the less the proportionate amount of school effort which is given to English, Latin, mathematics, history and civics; and the greater the proportionate amount devoted to modern languages, and technical and commercial subjects.

We now pass to the second table.

Table Showing Characteristics of Median School Among Groups of Schools with Varying Enrolments (After Counts)

Characteristics of median of schools enrolling						
	1-100	101-200	201-300	301-500	501-1,000	1,000+
No. pupils per class.....	12.5	17	19.5	21	22	24
No. pupils per teacher.....	11	18	21	22	22	26
Periods taught						
by supt.....	1	1	0	0	0	0
by prin.....	4	4	3	2	0	0
by teacher.....	4	5	5	5	5	5
Study periods supervised.....	0	4	5	6	8	13
Value of lab. equipment.....	\$2085	\$1985	\$2600	\$3875	\$6565	\$10,755
No. vols. in library.....	550	535	658	818	1288	2241
Amt. spent for books annually....	87	86	97	112	145	263
Percent of total units of work devoted						
to English.....	15.3	14.5	13.1	12.0	10.7	10.0
to Latin.....	13.0	12.6	11.9	11.0	9.4	7.9
to Mod. Lang.....	12.8	9.3	8.9	9.8	11.7	12.5
to Science.....	11.2	11.9	11.5	11.4	11.8	11.9
to Mathematics....	12.2	11.0	9.8	9.2	8.2	7.8
to Hist. and Civ..	12.2	12.0	11.3	10.3	9.6	8.2
to Tech. Subjs....	18.5	21.9	27.2	30.1	33.3	35.6
to Commerce.....	5.6	7.4	10.4	11.4	11.9	8.7

From this table and from the data from which it is drawn, we submit these conclusions and comments:

1. The size of class, and the ratio of pupils per teacher, increase with the increase in high-school enrolment. This fact, we think, has a most significant bearing upon existing studies,<sup>15</sup> which tend to show that size of class is of comparatively small importance in determining school efficiency. These studies, we believe, by failing to consider separately schools of different sizes, have admitted as a complicating factor the superior facilities of the larger schools which tend to offset the effect of the larger classes obtaining in these schools. Obviously, studies of the effect of size of class upon scholarship can have weight only when classes of different size in

<sup>15</sup>Harlan, C. L. Size of class as a factor in schoolroom efficiency. *Educational Administration and Supervision*, Vol. 1, 195-214.

schools of the same approximate size have been considered. In the study which follows, this problem will be attacked.

2. The larger schools demand the whole time of their principals and superintendents for supervisory and administrative functions, and make correspondingly larger demands upon their classroom instructors.

3. Supervision of study is practically ignored in the smaller schools.

4. The larger the school, the better the laboratory and library facilities.

5. The proportion of attention paid to the different subjects of instruction varies among high schools of different size as among cities of different size. The smaller schools still give the greater attention to the traditional subjects.

Counts remarks in another connection that "there seems to be greater tendency for students to leave school in the larger cities than in the smaller cities."

## CHAPTER III

### MATERIALS AND METHODS

The problems raised in this investigation have already been stated, but it is desirable at this point to recall them to the reader's attention. To determine the influence exercised upon the efficiency of a college student by the age at which he enters college, and by the general character of the high school from which he comes; that is our task. Two features constitute college efficiency in the meaning of the present study; first, the student's standing in his work, and second, his persistence in pursuing his course to the end.

Before undertaking to present the results of our inquiry into the influence exercised upon retention and scholarship by each of the factors named, attention must be called to the materials upon which these conclusions are founded and the methods by which they have been reached. A discussion of these matters constitutes the theme of the present chapter.

#### SECTION 1

##### MATERIALS

1. *Fundamental Materials.* The original data upon which the investigation is based were drawn from the registrar's records of two different classes entering the College of Science, Literature, and the Arts at the University of Minnesota in 1910 and 1911. These classes include a total of 828 students, distributed as follows:

Class	Males	Females	Total
1910.....	140.....	244.....	384
1911.....	189.....	255.....	444
Total.....	329.....	499.....	828

Both classes were traced throughout the four-year college course. These registrar's records also furnish the necessary data regarding the sex of the students, their comparative achievements in scholarship, and the lengths of their college careers.



2. *Accessory Materials.* Other sources of information were turned to for the data regarding the size, in number of pupils and teachers, of the various high schools, and for the high-school scholarship of the students under consideration. The uses made of these data will appear in our discussion of methods.

The reports of the state high-school inspector furnished the necessary information regarding the high schools of Minnesota, and a circular letter was sent to each of the superintendents of the schools involved outside the state, asking for similar information regarding his schools and teachers. In every case the data were secured for the particular year in which the students under consideration were graduated from each school.

There was also required a statement of the quality of the work done in the high school by each of the college students recorded, as compared with that done by his high-school classmates. Blanks were accordingly sent to each high school, both in and out of the state, requesting a summary of the marks earned during the senior year by all of the members of every graduating class which had sent one or more students to the Arts College of the University of Minnesota during the period under consideration. This request was restricted to the senior year of the high-school course because the scholarship shown during the last year probably would be more nearly typical of the settled achievement of each student than would that shown during the earlier pubescent years. Furthermore, different investigators have shown that a considerable degree of continuity exists between the scholarship rank of a pupil during one high-school year and his rank in preceding and succeeding years.<sup>1</sup>

3. *Evaluation of Materials.* Any attempt at original investigation must carefully weigh the materials upon which its conclusions are founded, as to (a) their accuracy, (b) their adequacy, and (c) their deeper implications.

(a) *Accuracy.* There is no reason to question the accuracy of the materials of the present study. The registrar's records, both of the University and the high schools, are official records, and are as reliable as such records anywhere. The supplementary question-

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<sup>1</sup>See Chapter I, Section 2.

naires dealt with matters of recorded fact rather than with matters of opinion, and should be correspondingly dependable.

(b) *Adequacy.* The different kinds of materials which it was necessary to collect could not be made uniformly adequate. The number of students for whom the college records were obtained is unusually large, so that no apology need be made for the quantity of original data. The data regarding size of high school and number of teachers per school have been made practically complete. But it was found impossible to make the collection of high-school scholarship records equally complete. We are able to present these standings for only 288 out of the 828 students whose college records were compiled. To secure even this number, the records of 3,644 high-school graduates had to be obtained. With the possible exception, then, of these high-school scholarship records, the data in all cases seem sufficient in quantity to justify the conclusions based upon them.

(c) *Implications.* We now turn to the problem of the deeper significance of these materials. If teachers' marks are as unreliable as many studies of them would imply, and if we are uncertain of the causes which determine their quality, how is it possible to use them as the basis of a study which seeks scientific validity? In reply we may say that there is a quantity of evidence to show that marks taken in sufficient numbers may be safely utilized. Several studies of the distribution of school marks<sup>2</sup> indicate that the composite curve representing thousands of marks conforms within a reasonable degree of variation to the normal or binomial curve. For this reason it has been held that such masses of marks portray with considerable accuracy some biological function. Again, a continuity has been shown to exist between the rank held by a student in the high school and the position which he later occupies in the college. A similar continuity between rank in the elementary school and the high school, and in the grammar school, the high school, and the college, has been established.<sup>3</sup> As the positions of these students were in every case determined upon the basis of school marks, the implication is that a continuity exists among the marks themselves which

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<sup>2</sup>See Chapter I, Section 1.

<sup>3</sup>See Chapter I, Section 2.

can hardly be the product of accident. A third thread of evidence is found in the fact that a student who ranks high in one line of school activity is very likely to rank high in other lines.<sup>4</sup> Here, again, all of the rankings have been based upon school and college marks, and the same implications must follow regarding the reliability of these marks when taken in sufficient numbers. The statistical usefulness of a body of material does not require that we know at the beginning the laws operating within the material, but simply that we have reason to suppose that it does follow some law. The gist of this accumulated evidence is that, whatever may be the causes determining the quality of school marks, these marks are sufficiently reliable for statistical purposes if there be enough of them.

The present study embraces more than 20,000 college scholarship marks, by actual count, and almost an equal number, estimated, of high-school marks. Table 1 and Graph I show the form of the distribution of the college scholarship marks. The curves for both sexes are skewed strongly toward the high end of the marking scale, but the females, upon the whole, earned considerably the better marks.

TABLE I

*Showing the Distribution of 20,090 College Scholarship Marks for Both Sexes and for Each of the Four College Years*

	Excellent	Good	Passed	Condition	Failed
Freshmen					
Males: Number.....	333	890	840	297	313
Percent.....	12.4	33.3	31.4	11.1	11.7
Females: Number.....	852	1578	1216	240	180
Percent.....	20.9	38.5	29.9	5.9	4.8
Sophomores					
Males: Number.....	249	661	632	182	171
Percent.....	13.1	34.8	33.3	9.6	9.0
Females: Number.....	856	1680	1058	232	82
Percent.....	21.8	42.9	27.2	5.9	2.2

<sup>4</sup>See Chapter I, Section 2.

## Juniors

Males: Number.....	287	526	310	76	35
Percent.....	23.2	42.6	25.1	6.2	2.9
Females: Number.....	674	1730	858	128	46
Percent.....	19.6	50.3	25.0	3.7	1.4

## Seniors

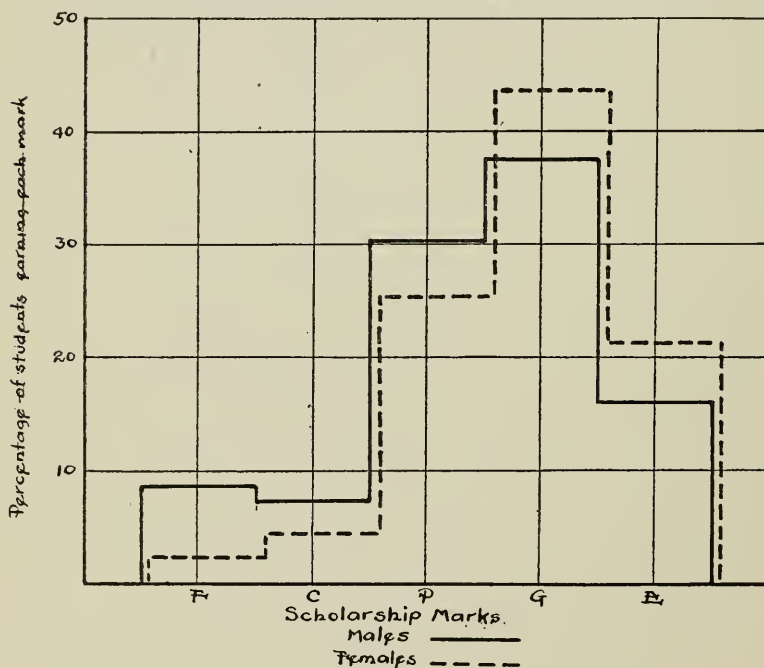
Males: Number.....	132	192	90	14	12
Percent.....	30.0	43.6	20.5	3.2	2.7
Females: Number.....	584	1470	380	28	10
Percent.....	23.6	59.5	15.4	1.1	0.4

## All Years

Males: Number.....	1001	2269	1872	569	531
Percent.....	16.0	3.63	29.9	9.1	8.5
Females: Number.....	2966	6458	3512	628	318
Percent.....	21.3	46.5	25.3	4.4	2.5

## GRAPH I.

DISTRIBUTION OF 20,090 COLLEGE SCHOLARSHIP MARKS, WITHOUT REFERENCE TO THE COLLEGE YEAR DURING WHICH THE MARKS WERE EARNED.



## SECTION 2

## METHODS OF STUDYING COLLEGE MATERIALS

1. *General Considerations.* During the early stages of the investigation, each of the two entrance classes, entering in 1910 and 1911, respectively, was studied separately. Each entrance class is logically a sort of competitive group, and the members of classes entering college in different years may not earn their marks under conditions quite identical. However, as this separate treatment of the two classes did not appear to be yielding results commensurate with the time it required, it was discontinued during the later stages.

Throughout the study the two sexes have been treated separately. It may be permissible to combine the sexes in studies having to do with the pre-adolescent period, although the wisdom of such a course is doubtful even then, but in investigations having to do with high-school and college students, such a method is almost sure to lead to serious error. In some of the results here rendered the males and females show considerable uniformity, but in other instances there appear very decided differences.

As has been said, two measures of comparative efficiency are utilized in this investigation. The first is the quality of scholarship shown by the marks each student received; the second is the length of time which each student remained at college work. The methods pursued in the application of each of these measures will now be described.

2. *Methods pursued in ranking students as to scholarship.* Most of the scholarship comparisons have been made by means of the ranking method. This method consisted of five steps: (a) finding the total number of marks of each denomination earned by each student in each year of his college course; (b) ascribing to each mark the numerical value stated in a succeeding paragraph; (c) finding the sum of these numerical equivalents in each pupil's annual record; (d) ranking the students of each entrance age, etc., in order of merit from highest to lowest according to these sums; and (e) finding the median pupil, and the first and third quartile pupils, in the groups representing the different entrance ages, sizes

of high school, etc. The special features of each step are next described.

(a) The marks totaled in the first step were the five marks in use in the College of Science, Literature, and the Arts in the University of Minnesota during the period covered by the investigation. These marks were in the form of letters; E, G, P, C, and F. Of these, E, G, and P represented "excellent", "good", and "passed", respectively; C represented a "condition", which might be removed by special examination or by partial repetition of work; and F represented a complete failure. Only one other mark, that of I, or "incomplete", appeared upon the records. In cases where this mark had not been removed by the later passing of the course it was changed to failure; where it had been removed the student was credited with the mark received on its removal. The term "mark" as here used means one semester's grade in one subject for the college, and one term's grade in one subject, for the high school.

(b) The second step in the process of ranking required the substitution of a numerical value for each of the college marks. The values selected were the following:

$$\begin{aligned} F &= -1 \\ C &= 0 \\ P &= 1 \\ G &= 2 \\ E &= 3 \end{aligned}$$

The mark C was given the value of zero because C represents no recognized progress toward graduation; P was given the value plus 1 because it represents one unit of such progress; and F was given the value minus 1 because it must be removed later by the student's retaking and passing the subject in which it was received, or by presenting an acceptable substitute. G was valued at plus 2 and E at plus 3 in order that the distances between the different units might remain uniform.<sup>5</sup>

(c) The procedure in Step 3 was very simple, consisting only in summing up the numerical equivalents for the marks earned by each student during each college year.

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<sup>5</sup>The writer acknowledges his indebtedness to an unpublished study by Professor David F. Swenson, of the University of Minnesota, for the numerical equivalents here utilized.

Various eliminations of marks, however, were found to be necessary. Work performed during summer school was not counted. All "no-credit" courses were excluded. Only the first mark given a student in a subject was considered, in all those cases where the subject had been repeated in order to raise the mark first received. In all such cases, except those originally marked "incomplete", no notice was taken of later marks, which were interpreted as concerned with a second set of facts not to be considered here.

(d) Step 4 is more intricate and much more difficult to describe. Let us therefore make it concrete. First we separated the data for the entrance classes, and started with the class entering in 1910. This class was then divided into two groups upon the basis of sex. Next, each of these sex groups was divided, upon the basis of age at entrance, or of character of high school. In the former case we would have, for instance, the males and females each brought into groups representing the 17-year-old entrants, the 18-year-old entrants, etc. The members of each of these age-groups were then ranked in order from highest to lowest, according to the sums of the numerical equivalents assigned to the marks of each student. Four separate rankings were thus made for each group, one for each college year.

(e) In Step 5, the median pupil was found for each group, for each college year, and the numerical value of the scholarship marks of this pupil was taken as the index of the scholarship of that group for the given college year. Comparison of the scholarship efficiency of the 17-year-old entrants with the 18-year-old entrants, etc., was made by means of these median equivalents. The range of variation in each group was also found in terms of the "middle 50 percent."

This process was repeated for the class entering in 1911. As a result we finally reach a statement of the median scholarship of the students entering at 17, 18, 19, 20, 21, etc., years of age for each sex and each college year, and for each of the two entrance classes. We also have a statement of the range of the middle 50 percent for each of these several groups.

The above procedure was duplicated in studying the scholarship achievements of students entering from the different types of

high schools, except that character of high school, rather than age at entrance was used to determine membership in each comparative group.

3. *Methods pursued in comparing the lengths of the students' college careers.* In general, the different student-groups described above were compared as to the percentage of members eliminated at different stages of the college course, usually at the end of each college year. The number of semesters during which the median member of each group remained in college was also used. All students were regarded as "eliminated" who were dropped from the rolls of the College of Science, Literature, and the Arts before the end of the course, and who did not reappear upon them. Such students as left the college to enrol in some other department of the University of Minnesota, as Law, Medicine, Agriculture, and Engineering, were included among the eliminations, but a statement of their number has been appended. It was found impossible to ascertain the number of those who left the University of Minnesota to enrol in some other institution.

4. *Evaluation of Methods.* Several features of the methods which have just been described may invite criticism.

First, objection is anticipated to the fact that equal weight has been attached to marks of the same denomination, irrespective of the teachers who gave them. The writer is perfectly aware that the marks of the different teachers do not mean the same thing. The G of one teacher is not always equal to the G of another teacher. Some teachers are notoriously high markers, and others are notoriously low markers. But in spite of these admitted differences, the marks of different teachers have been treated as equivalents for several reasons.

In the first place, the data were not accessible which would be necessary if one were to take strict account of teachers' individual differences. The proper procedure, from this point of view, would be to rank the members of each recitation group, under each individual instructor's marks. Later group rankings would then be found by combining the rankings given by the individual instructors. But such a procedure was impractical, in the present instance, because the registrar's records of the university did not take account



of individual teachers. The nearest possible approach would have been to find the rankings in separate subjects, but this would by no means have avoided the difficulty, for usually more than one instructor teaches the same subject.

In the second place, inspection of the data fails to reveal any noticeable correlation between age at entrance or character of high school and the departments in which the students elected to do most of their college work. Nor is there any evident reason for expecting such a correlation. In fact, a thorough study of the freshmen of one entrance class, dealing with the influence of age at entrance upon scholarship in the separate fields of English, mathematics, science, and history, brings out tendencies in each field exactly like those shown when the marks were treated *en masse*.

Finally, the method here employed does not necessarily assume that different teachers mean the same thing by the same mark. What it does assume is that in the long run the low markers and the high markers strike a fairly even balance. The error introduced is of the compensating and not of the cumulating sort. But even if it were assumed that identical scholarship marks possessed identical values, the example of every college and university which requires a student receiving a failure, no matter from what instructor, to repeat his work, and which passes every student marked "passed" and above by any and every teacher, might be pointed to as in a measure justifying that assumption.

The present study has departed from the usual plan of averaging the marks earned by a student during a given year in order to secure a measure of his scholarship. This study substitutes the sum of these marks for their averages. The reason for adopting this procedure is as follows:

The writer wishes to compare the scholarship shown by the different students in all of their work for each college year. He is concerned with their entire college accomplishment on record for each year. He does not wish to enter into the problem of comparative efficiency in different lines of subject matter. If he were to average the marks earned by each student during the whole college year, he would give weight to quality only, and would take no account of differences in the number of courses completed. He would thus put the student who carried two courses upon the same plane with the

one who carried five, provided that the quality of work done in the two cases was the same.

A striking example of this danger came to light in the course of the compilation. Two students were found, whom we may designate as *A* and *B*, each of whom had received a mark of G in rhetoric, German and chemistry. *A* carried only these three subjects; *B* had also entered a course in mathematics from which he emerged with a mark of P. If these marks had been averaged, *B* would have appeared as inferior to *A*, although he had received identical marks in all of the subjects taken by *A*, and had carried and passed one subject more. Clearly, the only way to treat such a situation is to consider both quantity and quality; that is, to total the marks.

However, it may be said that consideration of the averages of the marks in place of their totals would have made no marked change in the results. Inspection of Table 2, which is based upon 95 cases selected so as to represent all degrees of scholastic efficiency, demonstrates that the students who ranked high in the totals also ranked high in the averages; and conversely. Furthermore, the place of each individual in each of the two series is almost identical. The rank-difference coefficients are as follows: males  $0.98 \pm .01$ ; females,  $0.96 \pm .01$ .

A third possible source of error consists in the fact that equal weight has been given to every mark of the same denomination, regardless of differences in the number of hours per week which the various courses demanded. Thus Rhetoric 1 is a three-credit course, meeting three hours per week, while Mathematics 1 is a five-credit course, meeting five hours per week. Yet the study treats a G earned in Rhetoric 1 as equivalent to a G earned in Mathematics 1.

This is clearly not the perfect procedure, and can be justified only by its economy, and by the fact that the error involved is practically insignificant. Its insignificance is demonstrated in Table 3. This table compares the respective positions of 95 students selected so as to represent all degrees of scholastic efficiency, in two serial orders. The first series for each sex states the sum of the numerical equivalents of the marks earned by each student, before these marks had been weighted to take account of hour-differences. The second series shows the corresponding value for each pupil, when each mark had been weighed according to the number of hours required for the

TABLE 2

*A Comparison of Total-Mark Equivalents with Average-Mark Equivalents as Measures of Scholarship During the Freshman College Year*

(Only enough cases are given to serve as samples in different ranges.)

Males			Females		
Individual	Totals	Averages	Individual	Totals	Averages
1	-8.0	-1.0	1	-8.0	-1.0
2	-8.0	-8.0	2	-8.0	-1.0
3	-6.0	-1.0	3	-4.0	-1.0
4	-6.0	-0.75	4	0	0
5	-2.0	-0.40	5	2.0	0.25
6	-1.0	-0.20	6	5.0	0.71
7	0	0	7	6.0	0.67
8	0	0	8	7.0	0.875
9	2.0	0.33	9	7.0	1.16
10	2.0	0.25	10	8.0	0.89
11	4.0	0.50	11	9.0	1.125
22	10.0	1.00	22	13.0	1.30
23	10.0	0.91	23	13.0	1.62
24	11.0	1.10	24	14.0	1.75
41	20.0	2.00	44	24.0	2.18
42	20.0	2.00	45	25.0	2.50
43	22.0	2.20	46	26.0	2.70
44	23.0	2.30	47	27.0	2.70
45	26.0	2.89	48	28.0	2.80
46	30.0	3.00	49	30.0	2.50

course in which it was earned. Thus, a P in a three-hour subject was counted as 3, and a P in a five-hour subject as 5. Inspection of the table reveals a surprising similarity in the positions of almost every student in the two series. Expressed in terms of the rank-difference formula, we have for the males a coefficient of  $0.98 \pm .01$ ; and for the females a coefficient of  $0.97 \pm .01$ . The error arising from failure to weight the grades for number of hours per week may, therefore, be regarded as practically negligible.

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TABLE 3

*A comparison of the Total Mark Equivalents when Marks were Unweighted, with Equivalents when Each Mark was Weighted According to the Number of Hour-Credits Earned in Each Subject.*

(Only enough cases are given to serve as samples in the different ranges.)

Individual	Males		Individual	Females	
	Not Weighted	Weighted		Not Weighted	Weighted
1	-8	-32	1	-8	-32
2	-8	-18	2	-8	-28
3	-6	-22	3	-4	-16
4	-6	-22	4	0	-2
5	-2	-8	5	1	3
6	-1	-1	6	5	12
7	0	1	7	6	13
8	0	0	8	7	25
9	0	10	9	8	23
10	2	6	10	9	37
11	2	14	11	9	31
23	10	27	23	13	49
24	10	37	24	14	54
25	11	39	25	14	50
42	20	57	44	24	74
43	22	66	45	25	75
44	23	64	46	26	72
45	26	82	47	27	81
46	30	102	48	28	96
47			49	30	86

## CHAPTER IV

### ENTRANCE AGE AS RELATED TO COLLEGE EFFICIENCY

This chapter deals with the comparative scholarship and persistence of the groups who entered at various ages, *i. e.*, of the 17-year-old, the 18-year-old, the 19-year-old, etc., entrants. The 17-year-old entrants include students whose ages at the time of entering college ranged from 16 years, 6 months, to 17 years, 6 months. The 18-, 19-, and 20-year-old entrants, etc., each cover similar ranges.

The percentages of the students who entered at different ages are shown in Table 4.

TABLE 4  
*Percentage of College Entrants at Each Age*

Age at Entrance	Males			Females		
	Class 1910-11	Class 1911-12	Both Classes	Class 1910-11	Class 1911-12	Both Classes
16	2.2	2.8	2.5	1.6	0.8	1.2
17	8.8	9.8	9.2	9.1	8.7	8.8
18	20.6	26.2	24.5	38.2	36.5	37.2
19	32.3	29.3	30.2	28.9	30.2	29.2
20	22.1	15.9	18.4	10.9	15.8	13.5
21	5.1	9.3	7.6	6.6	3.9	5.3
22	4.4	2.7	3.2	1.6	1.8	1.8
23	2.4	1.6	1.9	0.4	0.4	0.4
24	0.7	0.6	0.7	0.9		0.5
25	0.7	0.6	0.7	0.4		0.2
26		1.2	0.7	0.4	0.8	0.7
27						
28				0.4		0.2
29	0.7		0.4		0.8	0.4
30				0.4		0.4
35				0.4	0.4	0.2

This table shows an extreme range in entrance-age of from 16 to 29 for the males, and from 16 to 35 for the females. Eighteen appears to be the modal entrance age for the females and 19 for the males. The median in both sexes is 19; the average for the males is 19.2, with a mean variation of 1.22; for the females, 18.9, *M. V.*, 1.12. The females were on the whole three tenths of a year younger

than the males when both began their college work. Despite the wider range in the females, comparison of the average variations shows that males were marked by the greater variability in entrance ages.

### SECTION 1

#### COMPARISON OF THE SCHOLARSHIP MARKS OF THE GROUPS ENTERING AT DIFFERENT AGES

The methods pursued in making these comparisons have been described at length in Chapter III. It is necessary at this point only to interpret the tables and graphs containing the results.

The reader is invited to turn first to the accompanying tables, and to observe the following points. Tables 5 to 7 show the number of males belonging to each of the different entrance-age groups, during each college year, and the comparative scholarship of each age-group; these data are presented separately for the two entrance classes (Tables 5 and 6), and for both classes combined (Table 7). Tables 8 to 10 present similar data organized in like fashion for the female entrants. Comparative scholarship is stated in terms of (1) the range between the number representing the total numerical equivalent of the marks of the lowest pupil in each group, and the number representing the marks of the pupil standing highest in each group; (2) the range between the number representing the pupil occupying the first quartile position and the number for the pupil occupying the third quartile position in each group; (3) and the number representing the total equivalents of the marks earned by the median pupil in each group. The median as thus described will be taken as the standard measure of central tendency, and the range of the middle 50 percent as the standard measure of variation, in that part of our study which is concerned with comparisons of efficiency as shown by scholarship marks.

It has not seemed desirable to attempt to present all of these features in the graphs. The median, being the measure of central tendency, is, of course, the fundamental unit of comparison, and must be portrayed. The range of the middle 50 percent or the interquartile range, is of considerable assistance in interpreting the median, and often in qualifying or elaborating inferences based

upon it. But no significant purpose would be served by an attempt to portray the extreme range in scholarship shown by each group, since the numerical values representing these extremes are often, if not always, accidental.

The reader's attention is now directed to Graph II.<sup>1</sup> Let us offer a concrete interpretation. This graph describes the scholarship achievements of the freshmen who entered at different ages; the males are represented on the left side of the graph, and the females on the right. Note, for illustration, the male curves. The heavy black curve represents the males of both entrance classes combined, and shows that the numerical value of the marks earned by the median pupil of the group who entered at sixteen was 14, of the group who entered at seventeen was 16, etc. After eighteen, the curve is seen to turn rapidly toward the base until twenty-two, after which it becomes generally normal again, indicating that the median students of the groups entering at ages from 19 to 22, stood lower in scholarship than those of the groups entering before and after these ages. The 25-year-old entrance group is a conspicuous exception. The horizontal broken lines represent the range of the middle 50 per cent, all male entrants considered. This is seen to follow the general tendency displayed by the median. The dotted and broken lines represent, respectively, the medians of the different age-groups in the entrance classes of 1910 and 1911.

The curves on the right-hand side of the graph, representing the female freshmen, may be interpreted in like manner. The most noticeable feature here is that the drop indicating a decline in scholarship from 19 to 22, while present, is much less pronounced than in the case of the males.

Graphs III, IV, and V are all to be interpreted like Graph II. These three graphs represent the sophomore, junior, and senior attainments of the entrants of different ages. Graph VI brings together, for purposes of closer comparison, the heavy black curves, or

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<sup>1</sup>The reader will note that in this and all succeeding graphs the curve representing scholarship merit runs vertically, rather than horizontally. In other words, scholarship values are represented on the abscissae, rather than on the ordinates, the latter being used to represent entrance ages, etc. The writer has two reasons for adopting this form: first, the graphs are thus made to correspond structurally to the tables; and second, this is the only graphic method which can be used consistently in all parts of the study.

"total" curves, of each of the other graphs. Inspection of this figure brings out the changes going on from year to year.

We can best summarize the conclusions from these tables and graphs under two heads; first, the differences in scholastic achievement marking the different age-groups during the freshman year; and second, the changes that appear in the course of the succeeding college years. Emphasis is put upon the differences appearing during the freshman year, because this was the only year in which all college entrants were in actual competition. Qualitative elimination becomes a disturbing factor later.

## FRESHMAN DIFFERENCES

1. Males entering at ages from 19 to 21 or 22 stood lower in scholarship than those entering younger.
2. The same general tendency appears among the females, but not to the same degree, nor so consistently.
3. After 22 the scholarship curves are extremely variable, owing to the small number of cases, but they suggest somewhat better attainments.

TABLE 5

*Comparative Scholarship, During Successive College Years, of Male Students Entering College in 1910 at Different Ages.*

Scholarship stated in terms of numerical equivalents of marks earned by the median student, the first and third quartile student, and the best and poorest students of each entrance age group.

Freshman Entrance Age	Freshmen					Sophomores				
	Number of Students	Median Schol- arship	Range of Middle 50 percent		Range of Scholar- ship Values	Number of Students	Median Schol- arship	Range of Middle 50 percent		Range of Scholarship Values
			1st Quar- tile	3d Quar- tile				1st Quar- tile	3d Quar- tile	
16	3	18	....	....	12 to 26	3	22	....	....	4 to 24
17	12	13	7.5	19.75	1 to 26	8	14	11.50	17.75	-8 to 25
18	30	11.5	2.75	17.5	-6 to 30	21	13	5.5	20	-8 to 30
19	43	12	7	16	-8 to 23	27	10	8	19	1 to 26
20	29	4	-3	13	-8 to 23	13	8	2	22.5	2 to 29
21	7	9	6	19	6 to 20	5	8	5	15	4 to 19
22	5	4	-1	13.5	-6 to 18	2	11	....	....	7 to 15
23	3	16	....	....	7 to 23	..	....	....	....	....
24	1	26	....	....	....	1	15	....	....	....
25	1	-6	....	....	....	..	....	....	....	....
26	..	....	....	....	....	..	....	....	....	....
27	..	....	....	....	....	..	....	....	....	....
28	..	....	....	....	....	..	....	....	....	....
29	1	17	....	....	....	1	11	....	....	....



Juniors						Seniors				
16	3	21	....	....	8 to 29	2	23	....	....	....
17	7	19	18	21	10 to 29	5	20	16.5	26	16 to 29
18	13	20	10	26	5 to 31	10	19.5	12.5	20.25	6 to 29
19	13	17	4.5	24.5	-4 to 30	10	19	15.75	22.75	-10 to 28
20	8	25	10.75	33.25	0 to 35	6	19	14.25	24	12 to 36
21	2	17	....	....	14 to 20	1	30	....	....	....
22	1	18	....	....	....	..	....	....	....	....
23	..	....	....	....	....	..	....	....	....	....
24	1	26	....	....	....	1	34	1	34	....
25	..	....	....	....	....	..	....	....	....	....
26	..	....	....	....	....	..	....	....	....	....
27	..	....	....	....	....	..	....	....	....	....
28	..	....	....	....	....	..	....	....	....	....
29	1	16	....	....	....	1	14	....	....	....

TABLE 6

Comparative Scholarship, During Successive College Years, of Male Students Entering College in 1911 at Different Ages.

Scholarship stated in terms of numerical equivalents of marks earned by the median student, the first and third quartile student, and the best and poorest students of each entrance age group.

Freshman Entrance Age	Freshmen					Sophomores				
	Number of Students	Median Scholarship	Range of Middle 50 percent		Range of Scholarship Values	Number of Students	Median Scholarship	Range of Middle 50 percent		Range of Scholarships Values
			1st Quartile	3d Quartile				1st Quartile	3d Quartile	
16	5	12	6.5	25	6 to 28	5	15	7	28.25	6 to 29
17	17	17	10	21.5	-4 to 27	14	15.5	12.75	20.25	9 to 28
18	47	15	6	19	-8 to 28	34	15	9	24	-8 to 37
19	52	8.5	2	11	-10 to 25	31	11	6	15	-8 to 28
20	29	6	0	11	-10 to 26	19	8	-2	15	-8 to 27
21	17	8	3	16.5	-8 to 24	10	7.5	3.75	15.5	-4 to 26
22	5	20	1	24.5	-2 to 28	4	16.5	-3	25.25	-6 to 26
23	3	16	....	....	-8 to 24	1	25	....	....	....
24	1	-2	....	....	....	..	....	....	....	....
25	1	-3	....	....	....	1	16	....	....	....
26	2	12	....	....	....	1	11	....	....	....
Juniors						Seniors				
16	4	21.75	....	....	12 to 28	1	27	....	....	....
17	13	17.25	12.5	22	6 to 26	6	17.25	15.37	22.74	14.25 to 23.2
18	28	20	14.5	26	8 to 32	19	22.5	18	28.5	1 to 37
19	14	16	13.5	18	8 to 37	9	21.75	19.5	30.12	18 to 37
20	8	11.5	4.5	9.75	0 to 22	3	21	....	....	6 to 21
21	6	15	8.5	21.5	4 to 32	3	-1.25	....	....	6 to 17
22	2	30	....	....	28 to 32	1	23.25	....	....	....
23	1	26	....	....	....	1	30	....	....	....
24	..	....	....	....	....	..	....	....	....	....
25	1	12	....	....	....	1	18.5	....	....	....
26	1	18	....	....	....	1	18.5	....	....	....
30	..	....	....	....	....	..	....	....	....	....

TABLE 7

Comparative Scholarship, During Successive College Years, of All Male Students Entering College at Different Ages.

Freshman Entrance Age	Freshmen					Sophomores				
	Number of Students	Median Schol- arship	Range of Middle 50 percent		Range of Scholar- ship Values	Number of Students	Median Schol- arship	Range of Middle 50 percent		Range of Scholarship Values
			1st Quar- tile	3d Quar- tile				1st Quar- tile	3d Quar- tile	
16	8	14	8.5	24	6 to 28	8	15	4.5	23.5	3 to 31
17	29	16	9	21	-4 to 27	22	15	12.75	20.25	-8 to 28
18	77	14	4.5	18.5	-8 to 30	55	15	8	21	-8 to 37
19	95	9	5	14	-10 to 25	58	10.5	8	16.25	-8 to 28
20	58	5	-1	11.5	-10 to 26	32	8	2	16	-8 to 29
21	24	8.5	6	17.25	-8 to 24	15	8	5	15	-4 to 26
22	10	6.5	2.5	20.25	-6 to 28	6	13.5	3.25	23.25	-6 to 26
23	6	16	3.25	23.25	-8 to 24	1	25	.....	.....	.....
24	2	12	.....	.....	-2 to 26	1	15	.....	.....	.....
25	2	-4.5	.....	.....	-6 to -3	1	16	.....	.....	.....
26	2	12	.....	.....	.....	1	11	.....	.....	.....
27	..	.....	.....	.....	.....	..	.....	.....	.....	.....
28	..	.....	.....	.....	.....	..	.....	.....	.....	.....
29	1	17	.....	.....	.....	1	11	.....	.....	.....
	Juniors					Seniors				
16	7	21	12	28	-8 to 29	3	23	.....	.....	23 to 27
17	20	18	13.25	20.75	6 to 29	11	17.25	16	23	14 to 29
18	41	20	14	26	5 to 32	29	20	17.25	24.37	1 to 37
19	27	16	11	23	-4 to 37	19	21.75	18.75	25	-10 to 37
20	16	17	7.5	24	0 to 35	9	18	16.5	20.75	-6 to 36
21	8	16	10.5	19.5	4 to 32	4	8	2.9	26.8	-6 to 30
22	3	28	.....	.....	18 to 32	1	23.25	.....	.....	.....
23	1	26	.....	.....	.....	1	30	.....	.....	.....
24	1	26	.....	.....	.....	1	34	.....	.....	.....
25	1	12	.....	.....	.....	1	18	.....	.....	.....
26	1	18	.....	.....	.....	1	13.5	.....	.....	.....
27	..	.....	.....	.....	.....	..	.....	.....	.....	.....
28	..	.....	.....	.....	.....	..	.....	.....	.....	.....
29	1	16	.....	.....	.....	1	14	.....	.....	.....



TABLE 9

Comparative Scholarship, During Successive College Years, of Female Students Entering College in 1911 at Different Ages.

Freshman Entrance Age	Freshmen					Sophomores				
	Number of Students	Median Schol- arship	Range of Middle 50 percent		Range of Scholar- ship Values	Number of Students	Median Schol- arship	Range of Middle 50 percent		Range of Scholarship Values
			1st Quar- tile	3d Quar- tile				1st Quar- tile	3d Quar- tile	
16	2	6.5	....	....	5 to 8	2	7.5	....	....	2 to 13
17	22	17	13.75	20.25	-4 to 24	20	21	16.25	26.75	5 to 30
18	94	16	10	20.25	-6 to 30	74	19	13	23.25	4 to 33
19	76	14	8	20.75	-6 to 27	51	16	11	23	-8 to 35
20	39	14	6	18	-8 to 28	27	14	12	20	-6 to 40
21	10	14	5.5	18	2 to 20	1	16	....	....	....
22	5	2	-2	16.5	-2 to 22	2	17	....	....	10 to 24
23	1	16	....	....	....	..	....	....	....	....
24	..	....	....	....	....	..	....	....	....	....
25	..	....	....	....	....	..	....	....	....	....
26	2	20	....	....	7 to 33	1	23	....	....	....
27	..	....	....	....	....	..	....	....	....	....
28	..	....	....	....	....	..	....	....	....	....
29	2	14	....	....	....	..	....	....	....	....
30	1	15	....	....	....	1	15	....	....	....
	Juniors					Seniors				
16	2	5.12	....	....	0 to 10	..	....	....	....	....
17	15	22	18	26	6 to 30	12	19.12	15.5	23	14 to 35
18	62	20	16	24	6 to 36	54	20.25	18	22.69	0 to 36
19	41	19.25	16	23	4 to 36	31	21	17.25	24.75	11 to 34
20	20	18.75	14	24	8 to 26	15	20.25	17.5	23.25	15 to 28
21	1	10	....	....	....	1	15	....	....	....
22	1	24	....	....	....	1	19.5	....	....	....
23	..	....	....	....	....	..	....	....	....	....
24	..	....	....	....	....	..	....	....	....	....
25	..	....	....	....	....	..	....	....	....	....
26	1	18	....	....	....	1	16.5	....	....	....
27	..	....	....	....	....	..	....	....	....	....
28	..	....	....	....	....	..	....	....	....	....
29	..	....	....	....	....	..	....	....	....	....
30	1	26	....	....	....	1	15	....	....	....

TABLE 10

Comparative Scholarship, During Successive College Years, of All Female Students Entering College at Different Ages.

Freshman Entrance Age	Freshmen					Sophomores					
	Number of Students	Median Scholar- ship	Range of Middle 50 percent		Range of Scholar- ship Values	Number of Students	Median Scholar- ship	Range of Middle 50 percent		Range of Scholarship Values	
			1st Quar- tile	3d Quar- tile				1st Quar- tile	3d Quar- tile		
16	6	14	7.25	26.5	5 to 28	6	15	8	27.5	2 to 32	
17	42	16	12.75	19.25	-4 to 29	35	21	15	26	3 to 30	
18	182	15.5	11	20	-6 to 32	149	18	13	23	1 to 35	
19	144	13.5	9	19	-8 to 31	108	17	12	20.75	8 to 36	
20	66	14	7	17.25	-8 to 28	45	15	11	22	-10 to 40	
21	26	15	8	20.25	2 to 26	11	23	12	24	7 to 26	
22	10	8	1	22.5	-2 to 25	5	12	5	25.5	0 to 27	
23	2	18	.....	.....	16 to 20	1	30	.....	.....	30	
24	2	18	.....	.....	15 to 21	2	20	.....	.....	14 to 26	
25	1	15	.....	.....	15	1	16	.....	.....	16	
26	3	16	.....	.....	7 to 33	2	22.5	.....	.....	22 to 23	
27	0	.....	.....	.....	.....	0	.....	.....	.....	.....	
28	1	12	.....	.....	12	1	10	.....	.....	10	
29	2	14	.....	.....	3 to 25	0	.....	.....	.....	.....	
30	2	9	.....	.....	3 to 15	2	10.5	.....	.....	6 to 15	
35	1	4	.....	.....	4	0	.....	.....	.....	.....	
			Juniors				Seniors				
16	6	18.5	7.69	24.25	0 to 37	4	18.5	17.25	21.25	17 to 22	
17	27	21	15	26	6 to 30	22	19.75	17.19	23.06	13.75 to 35.50	
18	126	20	16	24.25	6 to 36	108	20	17.25	22	-6 to 36.75	
19	90	19.37	16	26	0 to 36	73	20.25	17	24	8 to 37	
20	36	19.5	14	24	8 to 33	31	21	18	24	14 to 30	
21	10	20	17.5	30.25	8 to 34	6	18.5	14.75	22.5	14 to 27	
22	3	23	.....	.....	18 to 24	2	18.75	.....	.....	18 to 19.5	
23	0	.....	.....	.....	.....	0	.....	.....	.....	.....	
24	1	23	.....	.....	23	1	23	.....	.....	23	
25	1	25	.....	.....	25	1	28	.....	.....	28	
26	1	18	.....	.....	18	1	16.5	.....	.....	16.5	
27	0	.....	.....	.....	.....	0	.....	.....	.....	.....	
28	0	.....	.....	.....	.....	0	.....	.....	.....	.....	
29	0	.....	.....	.....	.....	0	.....	.....	.....	.....	
30	1	26	.....	.....	.....	1	22.5	.....	.....	22.5	
35	0	.....	.....	.....	26	0	.....	.....	.....	.....	

TABLE 11

*Number of Semesters Spent in College by the Median Student, the First and Third Quartile Students, and the Two Extreme Students of Each Age-Group. Males Entering in 1910.*

Age at Entrance	Number of Students	Median Semester Retention	Middle 50 Percent		Range of Semester Retention
			1st Quartile	3d Quartile	
16	3	8	..	..	5 to 8
17	12	5.75	2	8	2 to 8
18	30	4	2	8	1 to 8
19	43	4	2	6	1 to 8
20	29	2	1	5	1 to 8
21	7	4	2	5	2 to 8
22	5	1	1	4.5	1 to 5
23	3	2	..	..	2 to 2
24	1	5	..	..	..
25	1	1	..	..	..
26	..	..	..	..	..
27	..	..	..	..	..
28	..	..	..	..	..
29	1	8	..	..	..

TABLE 12

*Number of Semesters Spent in College by the Median Student, etc. Males Entering in 1911.*

Age at Entrance	Number of Students	Median Semester Retention	Middle 50 Percent		Range of Semester Retention
			1st Quartile	3d Quartile	
15	..	..	..	..	..
16	5	5.75	3.25	6	3 to 6
17	17	5.75	5.38	8	1 to 8
18	47	5.5	2	8	1 to 10
19	52	3	2	5.5	1 to 8
20	29	3	2	5.5	1 to 10
21	17	3	2	5.5	1 to 8
22	5	3	2.5	6.75	2 to 8
23	3	1	..	..	1 to 8
24	1	1	..	..	1
25	1	8	..	..	8
26	2	5	..	..	1 to 8

No entrants older than 26 in this class.

TABLE 13

Number of Semesters Spent in College by the Median Student, etc. All Males.

Age at Entrance	Number of Students	Median Semester Retention	Middle 50 Percent		Range of Semester Retention
			1st Quartile	3d Quartile	
16	8	6	5.5	6.25	1 to 8
17	29	5.75	2.25	8	1 to 8
18	77	5.5	2	8	1 to 10
19	95	3	2	5.5	1 to 8
20	58	3	2	5.5	1 to 10
21	24	3.5	2	5.5	1 to 10
22	10	3	1	5.5	1 to 8
23	6	2	1	3.5	1 to 8
24	2	4.5	..	..	1 to 8
25	2	5.5	..	..	1 to 10
26	2	5	..	..	2 to 8
27	..	..	..	..	..
28	..	..	..	..	..
29	1	8	..	..	8
30	..	..	..	..	..

TABLE 14

Number of Semesters Spent in College by the Median Student, etc. Females Entering in 1910

Age at Entrance	Number of Students	Median Semester Retention	Middle 50 Percent		Range of Semester Retention
			1st Quartile	3d Quartile	
16	4	8	5.75	8	5 to 8
17	20	6.25	2.5	8	1 to 8
18	88	8	4	8	1 to 8
19	68	8	4	8	1 to 8
20	27	8	2	8	1 to 8
21	16	5	2	8	1 to 8
22	5	4	2	7	2 to 8
23	1	3	..	..	3
24	2	6	..	..	4 to 8
25	1	8	..	..	..
26	1	4	..	..	..
27	0	..	..	..	..
28	1	4	..	..	..
29	0	..	..	..	..
30	1	3	..	..	..
35	1	2	..	..	..

TABLE 15

*Number of Semesters Spent in College by the Median Student, etc. Females Entering in 1911.*

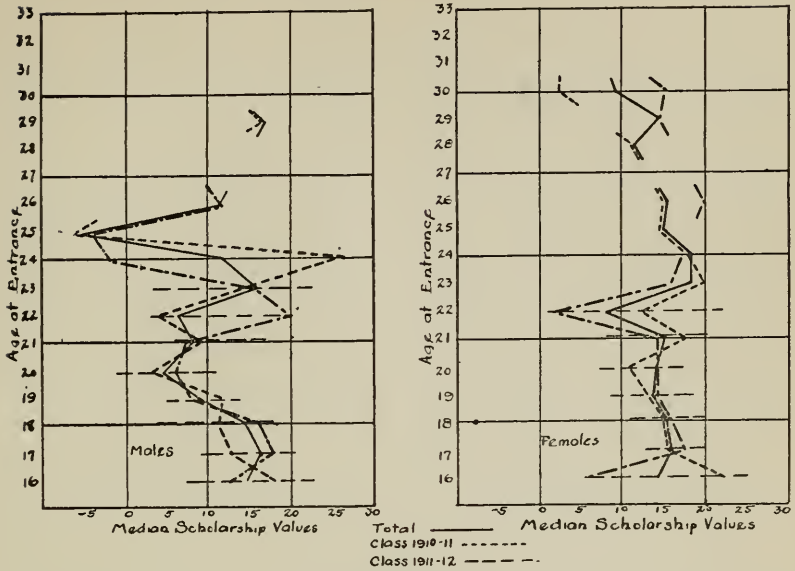
Age at Entrance	Number of Students	Median Semester Retention	Middle 50 Percent		Range of Semester Retention
			1st Quartile	3d Quartile	
16	2	5.5	..	..	5 to 6
17	22	8	4	8	1 to 10
18	94	8	3	8	1 to 10
19	76	5.5	2	8	1 to 10
20	39	5.5	2	8	1 to 8
21	10	2	1.75	2	1 to 8
22	5	1	1	6	1 to 8
23	1	1	..	..	1
24	..	..	..	..	..
25	..	..	..	..	..
26	2	6	..	..	2 to 10
27	..	..	..	..	..
28	..	..	..	..	..
29	2	2	..	..	2
30	1	8	..	..	8

TABLE 16

*Number of Semesters Spent in College by the Median Student, etc. All Females.*

Age at Entrance	Number of Students	Median Semester Retention	Middle 50 Percent		Range of Semester Retention
			1st Quartile	3d Quartile	
16	6	7.75	5.25	8	5 to 8
17	42	7.75	4	8	1 to 10
18	182	8	4	8	1 to 10
19	144	6.5	2.5	8	1 to 10
20	66	5.5	2	8	1 to 8
21	26	2	2	7	1 to 8
22	10	3	1	6.5	1 to 8
23	2	2	..	..	1 to 3
24	2	6	..	..	4 to 8
25	1	8	..	..	8
26	3	4	..	..	2 to 10
27	0	..	..	..	..
28	1	4	..	..	4
29	2	2	..	..	2
30	2	5.5	..	..	3 to 8
35	1	2	..	..	2

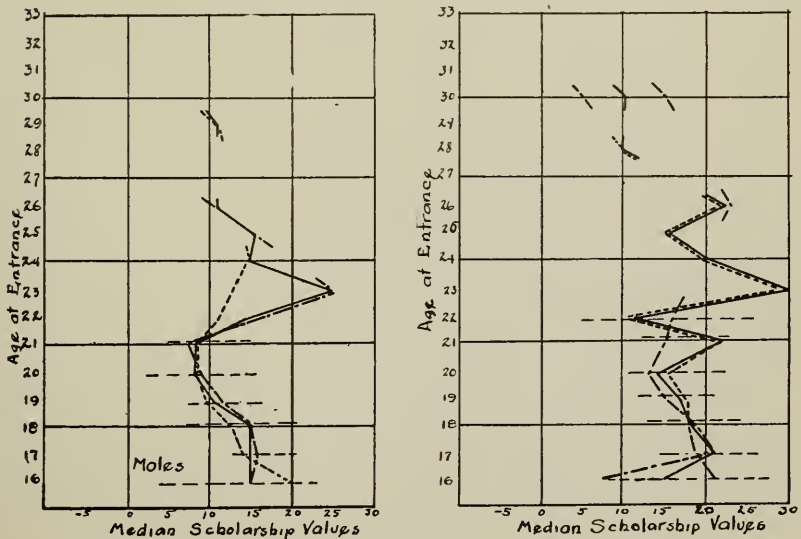




GRAPH II.

COMPARATIVE SCHOLARSHIP DURING FRESHMAN YEAR OF STUDENTS ENTERING COLLEGE AT DIFFERENT AGES.

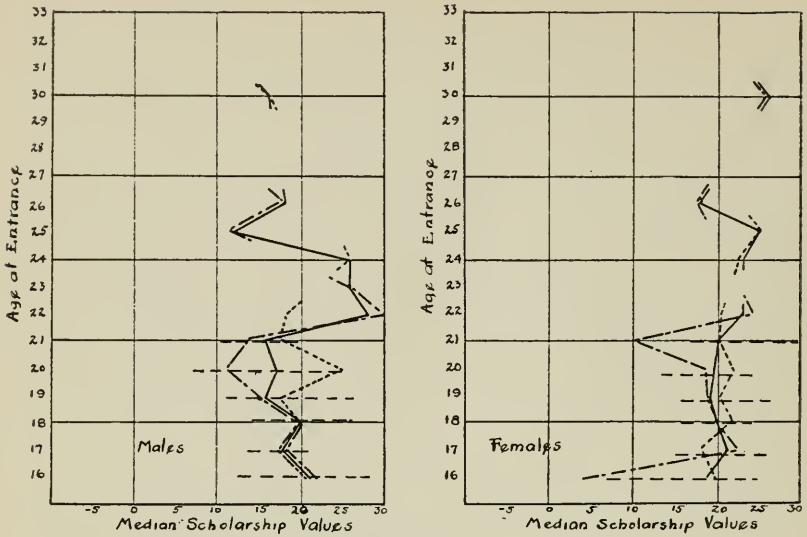
The horizontal broken lines indicate the range of each "middle 50 percent."



GRAPH III

COMPARATIVE SCHOLARSHIP DURING SOPHOMORE YEAR OF STUDENTS ENTERING COLLEGE AT DIFFERENT AGES.

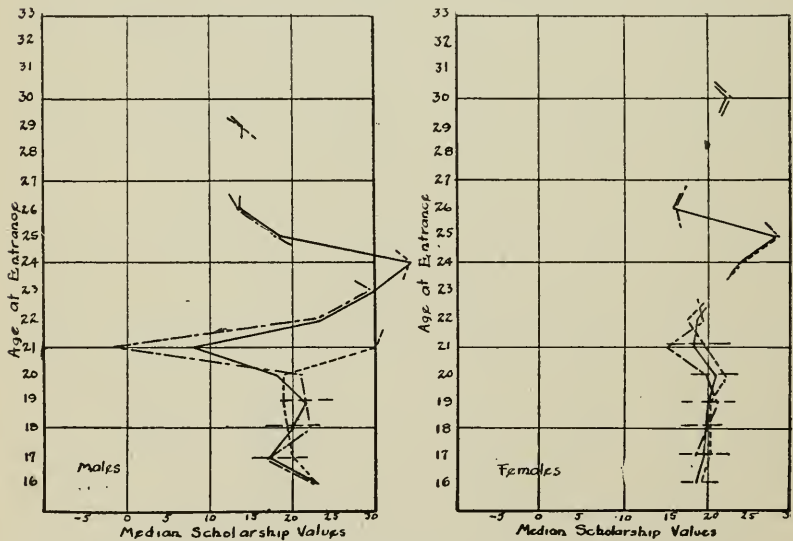
The horizontal broken lines indicate the range of each "middle 50 percent."



GRAPH IV.

COMPARATIVE SCHOLARSHIP DURING JUNIOR YEAR OF STUDENTS ENTERING COLLEGE AT DIFFERENT AGES.

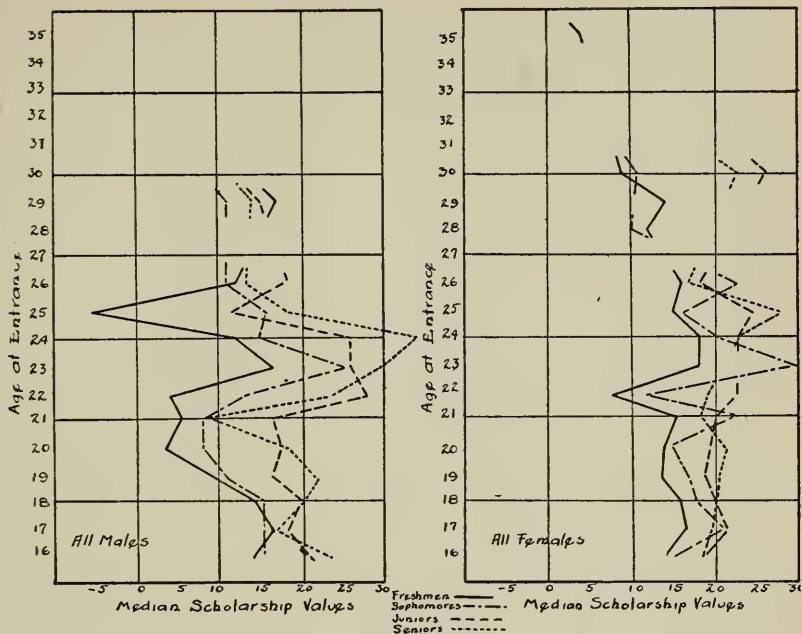
The horizontal broken lines indicate the range of each "middle 50 percent."



GRAPH V.

COMPARATIVE SCHOLARSHIP DURING SENIOR YEAR OF STUDENTS ENTERING COLLEGE AT DIFFERENT AGES.

The horizontal broken lines indicate the range of each "middle 50 percent."



GRAPH VI.

COMPARATIVE SCHOLARSHIP DURING SUCCESSIVE COLLEGE YEARS OF STUDENTS ENTERING COLLEGE AT DIFFERENT AGES.

DIFFERENCES APPEARING DURING SUCCEEDING COLLEGE YEARS

1. In both sexes the depression representing the intermediate ages from 19 to 21 or 22 decreases in passing from the freshman to the senior year, and practically disappears by the time the latter year is reached; the males who entered at 21 and the females who entered at 21 and 22, alone still show some deficiency in the senior year.

2. There is an increase in the standard of scholarship shown by all entrance groups up to the junior year, but little increase is noticeable between the junior and the senior years.

3. This increase in standard of scholarship from year to year

is more marked among the older than among the younger entrants, in both sexes, but particularly in the males.

All three of the changes described as occurring from year to year are closely connected with the elimination phenomena to be outlined in the next section. A discussion of these changes, independent of the elimination factor, will appear in the next chapter, where the record of those students who remained for four full years is separately described.

## SECTION 2

### RELATION BETWEEN ENTRANCE AGES AND COLLEGE EFFICIENCY AS DISPLAYED BY ELIMINATION AND RETENTION

The relation between annual entrance age and retention in college is important for two reasons; first, it furnishes another criterion of college efficiency; and second, it affords a means of explaining, at least in part, the increase in standards of scholarship which we have found appearing in successive college years.

We shall attempt to demonstrate this relationship, first, in terms of the number of semesters which the median student of each age-group remained in college; and second, in terms of the percent dropped from each age-group during or at the end of each college year.

1. *Retention described in terms of semester retention of median pupil.* The tables and graph here presented (Tables 11 to 16, and Graph VII), resemble, in form, those of the preceding section. The semester retention of each age-group is stated in terms of (1) the extreme range, (2) the range of the middle 50 percent, and (3) the median. The sole difference is that here are portrayed the number of semesters spent in college by the median, the first and third quartile, and the two extreme students of each age-group that is represented, rather than their marks.

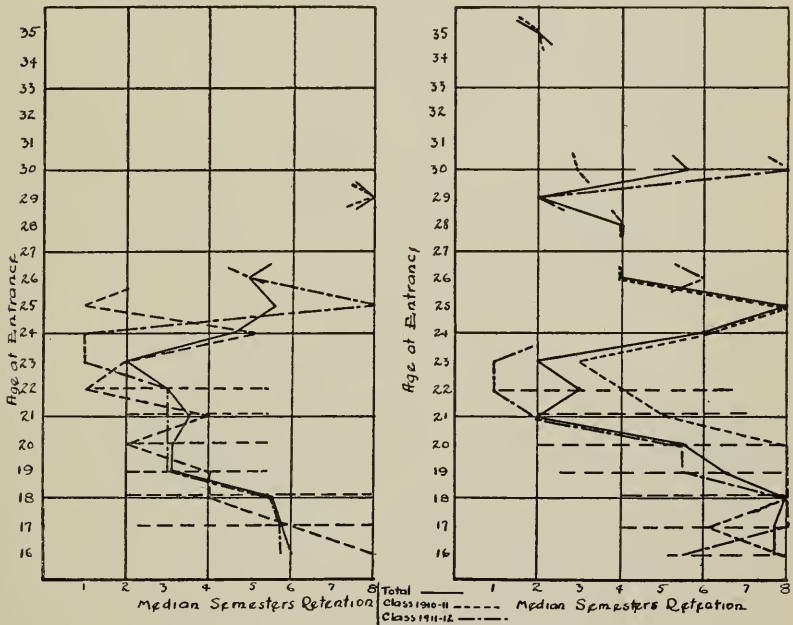
Reference to the "total" curves in Graph VII reveals the following facts:

a. The retention curves, like the mark curves, are bi-modal. Again the central depression (or bend toward the abscissa) begins with the entrance age of 19, but here extends to include the 22-year-old entrance group.

b. The superiority of the older entrants (above 23) in retention is more marked and more consistent than their superiority in scholarship.

c. The middle 50 percent shows a change in position with the different entrance ages which fairly parallels the changes shown by the medians.

2. Retention described in terms of percentages eliminated annually. Tables 17 and 18, with Graphs VIII and IX, state the percentages of the two entrance classes combined who were eliminated during, or at the end of, the freshman, sophomore, and junior college years. Senior eliminations were too few to be considered in terms of annual entrance ages. An attempt is also made in these tables and graphs to evaluate two important causes of elimination; *i. e.*, poor scholarship and change in college plans.

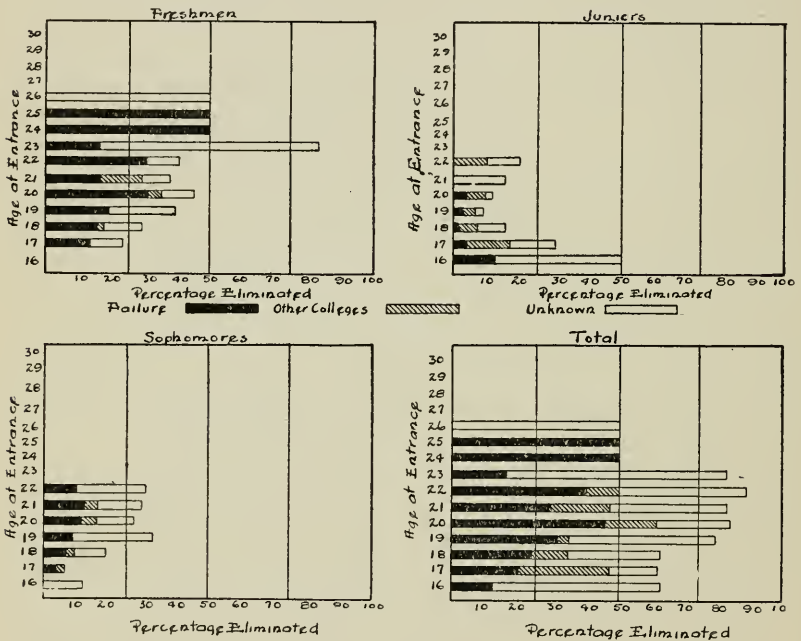


GRAPH VII.

COMPARATIVE RETENTION OF STUDENTS ENTERING COLLEGE AT DIFFERENT AGES, STATED IN TERMS OF THE NUMBER OF SEMESTERS WHICH THE MEDIAN STUDENT OF EACH ENTRANCE-AGE GROUP REMAINED IN COLLEGE.

(The horizontal broken lines indicate the range of the "middle 50 percent.")

The University of Minnesota has had a ruling to the effect that any student who stood below passing grade in three or more subjects should be dropped. To the students leaving college under these conditions, we have added those who received a C or an F in all of their work in case they were carrying fewer than three subjects. These students we have regarded as eliminated clearly because of poor scholarship, and have so entered them in the tables and graphs. It is highly probable that, through discouragement, poor scholarship caused the elimination of many others, but the extent of this influence cannot be measured. Certainly, we remain well within the truth when we confine our tables to those cases in which the university could take action.



GRAPH VIII.

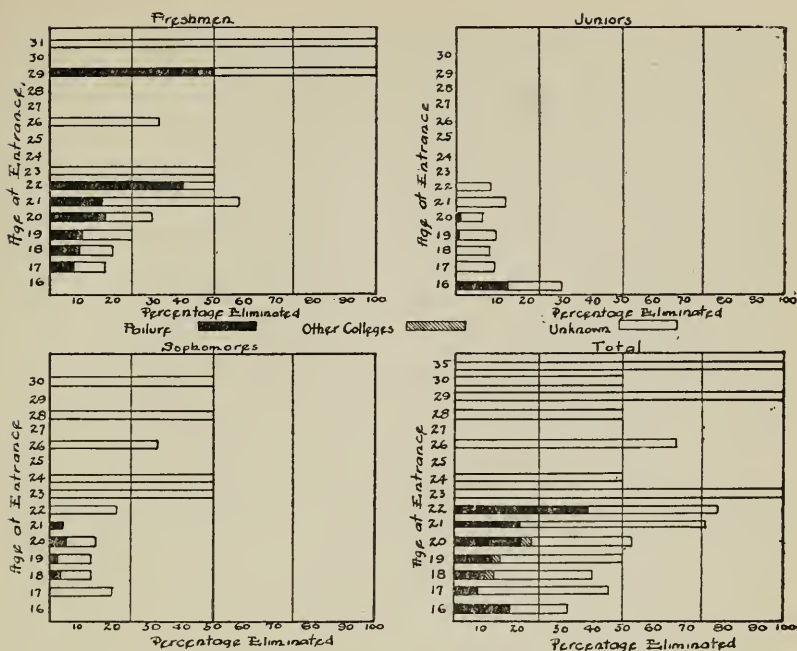
COMPARATIVE ELIMINATION, WITH PRINCIPAL CAUSES, OF MALES ENTERING COLLEGE AT DIFFERENT ENTRANCE-AGES.



TABLE 18  
*Percents of Female Entrants Eliminated in Each College Year for Stated Causes.*

Age at Entrance	Number of Students	Freshman Eliminations				Sophomore Eliminations				Junior Eliminations				Total Eliminations			
		Total Per-centage Eliminated	For Poor Scholarship	To Enter Other Departments	Cause Unknown	Total Per-centage Eliminated	For Poor Scholarship	To Enter Other Departments	Cause Unknown	Total Per-centage Eliminated	For Poor Scholarship	To Enter Other Departments	Cause Unknown	Total Per-centage Eliminated	For Poor Scholarship	To Enter Other Departments	Cause Unknown
16	6	..	..	..	..	..	..	..	..	33.3	16.7	..	16.7	33.3	16.7	..	16.7
17	42	16.7	7.1	..	9.6	..	..	19.0	..	11.9	..	..	11.9	47.6	7.1	..	40.5
18	182	18.1	7.2	1.1	9.8	0.5	0.5	10.5	..	9.9	..	..	9.9	40.6	8.8	1.6	30.2
19	144	25.0	7.6	1.4	16.0	4.5	..	9.0	9.0	11.8	0.7	..	11.1	49.3	10.4	1.4	37.5
20	66	31.8	13.6	1.5	16.7	4.5	..	9.0	..	7.6	1.5	..	6.1	52.9	19.6	1.5	31.8
21	26	57.7	15.4	..	42.3	3.8	..	..	..	15.4	..	..	15.4	76.9	19.2	..	57.7
22	10	50.0	40.0	..	10.0	..	..	20.0	..	10.0	..	..	10.0	80.0	40.0	..	40.0
23	2	50.0	..	..	50.0	..	..	50.0	..	..	..	..	..	100.0	..	..	100.0
24	2	..	..	..	..	..	..	50.0	..	..	..	..	..	50.0	..	..	50.0
25	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	3	33.3	..	..	33.3	..	..	33.3	..	..	..	..	..	66.7	..	..	66.7
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	1	..	..	..	..	..	..	50.0	..	..	..	..	..	50.0	..	..	50.0
29	2	100.0	50.0	..	..	..	..	..	..	..	..	..	..	100.0	50.0	..	50.0
30	2	..	..	..	..	..	..	50.0	..	..	..	..	..	50.0	..	..	50.0
35	1	100.0	..	..	..	..	..	100.0	..	..	..	..	..	100.0	..	..	100.0





GRAPH IX.

COMPARATIVE ELIMINATION, WITH PRINCIPAL CAUSES, OF FEMALES ENTERING COLLEGE AT DIFFERENT AGES.

In the columns headed "Other Departments" we have included those who left the College of Arts and Sciences to enter some other college department of the University of Minnesota.<sup>2</sup> Changes to other colleges outside the university are not recorded; there are no data available upon that subject.

The material contained in the tables is fully represented in the graphs. We may consequently base our inferences upon the latter alone.

<sup>2</sup>These "other departments" include the Colleges of Law, Medicine, Dentistry, Pharmacy, Engineering, and Agriculture. Students transferring to the College of Education were treated as continuing in the College of Arts, because the greater part of their work was still in the latter college. The caption "other departments" is used in preference to "other colleges," to avoid confusion of these students with those who left the University of Minnesota to enter college elsewhere.

1. In both sexes the elimination occurs mostly during the freshman year, and least during the junior year.

2. During the freshman and sophomore years, in both sexes, elimination increases generally with increase in entrance age. In the junior year, this tendency appears to be reversed.

3. Inspection of the "total" section of each graph shows that, in both sexes, elimination is greater from ages 19 to 23, inclusive, than from ages 16 to 18, or 24 to 26. The graph for females shows another increase in the more advanced entrance ages, but the cases here are few in number.

4. Both causes of elimination noted, poor scholarship and change from one department to another, are more effective among the males than among the females.

5. Among the males, poor scholarship is far more effective during the freshman year, and change of department is somewhat more important during the junior year. Both causes display their greatest influence upon the females during the freshman year.

6. Poor scholarship eliminations show a general tendency to increase with entrance-age up to the 25-year-old male entrants and the 22-year-old female entrants.

### SECTION 3

#### SUMMARY

The foregoing facts demonstrate the existence of certain relations between the ages at which these students entered college and the quality and consistency of their college work.

The point to which we would call particular attention is the clear inferiority, at least during the freshman year, of what we may call the middle entrance ages, most marked from 20 to 22. This inferiority is evident both in scholarship and in retention. The students who entered college after 19 and before 23 or 24, therefore, showed inferior efficiency, as compared with those who entered younger. The students who entered after the ages of 23 or 24 are too few in number to be very dependable, but there would appear

to have been some improvement in their cases. The differences mentioned, particularly the scholarship differences, are more conspicuous among the males than among the females.

In passing from the freshman to the senior college year, the groups which showed marked deficiency during the freshman year practically overtook the other groups. One cause of this phenomenon is very clear; *i. e.*, that there was a greater proportional elimination of poor students from these middle-age groups during the early college years. In a later chapter, we shall present what is at least a partial explanation of all of the phenomena which we have just described.

The preceding study of the individual entrance ages suggests the feasibility of combining these ages for further treatment into three groups, which we may call the normal, the pre-normal, and the post-normal entrance-ages. A discussion of the college efficiency of the students making up each of these three groups follows in the next chapter.

## CHAPTER V

### NORMAL, PRE-NORMAL, AND POST-NORMAL ENTRANCE AGES AS RELATED TO COLLEGE EFFICIENCY.

This chapter aims to contrast the efficiency shown by those students who entered college at what may be deemed a normal entrance age, with that of those who entered before or after normal age.

Our first problem is to determine what may be regarded as the normal age or ages at which students should enter college. This we may arrive at, first, as follows: In an earlier chapter we have noted that the most auspicious age for entrance into the elementary school seems to be six.<sup>1</sup> It is contended by many authorities that normal progress through the grades should be based upon entrance at the age of six, plus one year to allow for the frequent repetition of the first grade.<sup>2</sup> Adding twelve years, the length of the standard American pre-collegiate course, to six years, the normal age for entering the elementary school, gives eighteen as the normal age for entrance at college, irrespective of sex. Allowance for the year of leeway recommended by many writers, would extend this normal entrance period to include nineteen. Eighteen and nineteen thus become the normal ages for college entrance. This idea is confirmed by King's statement that 60 percent of our pupils enter the high school at fourteen and fifteen, and that there is little difference between the sexes in this regard.<sup>3</sup>

The conclusion may be confirmed thus: The percentages of college students who entered at different ages, as found in the present study, have already been presented in Table 4. In this table we find that fully 60 percent of the students of both sexes entered at the ages of eighteen and nineteen, and that more students

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<sup>1</sup>See Chapter II, Section 1.

<sup>2</sup>Van Sickle, Witmer, and Ayres. *Provision for Exceptional Children in Public Schools*. Bulletin U. S. Bureau of Education, 1911. No. 14.

<sup>3</sup>King, Irving. *The High School Age*. Bobbs-Merrill, 1914, p. 187.

of each sex entered at either of these ages than entered at any other one age. If the comparative number of entries, therefore, can be taken to indicate the normal time for entering college, then ages eighteen and nineteen are again shown to be the normal ages for entrance, while ages preceding these may be regarded as pre-normal, and ages following them as post-normal. A comparison of the efficiency of the students who entered before 18, at 18 and 19, and after 19 years of age, constituting respectively our pre-normal, normal, and post-normal entrance groups, becomes the problem of this chapter.

## SECTION 1

### COMPARATIVE COLLEGE EFFICIENCY AS MEASURED BY SCHOLARSHIP MARKS

The tables and graphs accompanying this section are similar in form and interpretation to those in Section 1 of Chapter IV. There are but two differences. First, we consider here only three entrance groups, each a combination of several of the age-groups discussed in the previous chapter. Secondly, we discontinue separate treatment of the classes entering in 1910 and 1911. In this chapter, and henceforth throughout the study, we shall treat these classes as if they formed a single entering class, in order to simplify our presentation and to deal with the largest possible numbers. The author, however, has carried through the study for each class separately, and has found that each class alone displays the same general tendencies shown by the combined classes.

The reader's attention is first directed to Table 19, illustrated by Graph X. Table 19 shows the comparative scholastic efficiency, measured by the total mark values used in the preceding chapter, of the males and females entering at, before and after normal entrance-age. The scholarship of each group is displayed in terms of (1) the median student, (2) the first- and third-quartile students, and (3) the total range between the best and poorest student in each series. Comparisons are made separately for each of the four college years. Graph X illustrates the columns entitled "Median Scholarship" in the table, with lines of different character indicating the

TABLE 19

*The Comparative Scholarship Values, in Terms of the Median, Middle 50 Percent and Total Range, of Students Entering College at, before, and after Normal Age.*

Age at Entrance	Males					Females				
	Number of Students	Median Scholarship	Middle 50 percent		Range of Scholarship Values	Number of Students	Median Scholarship	Middle 50 percent		Range of Scholarship Values
			1st Quartile	3d Quartile				1st Quartile	3d Quartile	
	Freshmen					Freshmen				
Pre-Normal	37	16	9	21	-4 to 28	48	16	11.25	19.75	-4 to 29
Normal	172	10	5	17	-10 to 30	326	15	10	20	-8 to 32
Post-Normal	105	8	0	15	-10 to 28	116	14	7	18	-8 to 33
	Sophomores					Sophomores				
Pre-Normal	30	15	10.75	21.75	-8 to 31	41	21	15	26	2 to 32
Normal	113	14	8	19	-8 to 37	257	17	13	23	-6 to 36
Post-Normal	57	9	4.5	16	-8 to 29	70	16	11.5	24	-10 to 40
	Juniors					Juniors				
Pre-Normal	27	18	13	22	-8 to 29	33	20	16	26	0 to 37
Normal	68	18	14	25.75	-4 to 36	216	20	16	25	0 to 36
Post-Normal	31	18	12	26	0 to 35	53	20	16	24.5	8 to 34
	Seniors					Seniors				
Pre-Normal	14	21.25	16.75	23.06	14.25 to 29	26	19.25	17.19	23	13.75 to 35.5
Normal	48	20.62	17.25	24.94	-10 to 37.5	181	20	17	23	-6 to 37
Post-Normal	19	18	13.5	20	-6.5 to 36	43	20.25	18	24	14 to 30

different college years. Inspection of the table with its accompanying graph brings out these facts:

1. During the freshman and sophomore years, the pre-normal entrants, both male and female, showed the highest scholarship, and the post-normal entrants showed the lowest.

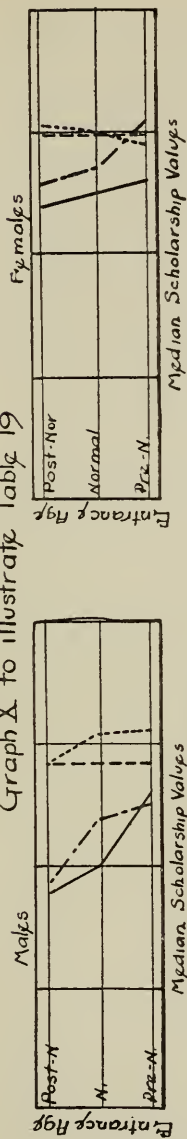
2. The differences in the achievements of these three entrance-groups were most pronounced among the males.

3. During the junior and seniors years, the achievements displayed by the three entrance-age groups were more nearly identical.

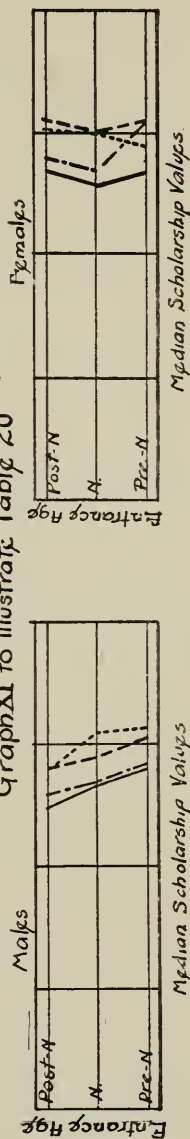
4. The female seniors showed a slight tendency to reverse the relations obtaining during the first two college years. That is to say, the post-normal entrants now displayed greatest efficiency, and the pre-normal entrants least.

5. All three entrance-age groups showed a general rise in the quality of the marks received, in passing through the successive

Graph X to illustrate Table 19



Graph XI to illustrate Table 20



college years. This tendency is greatest in the post-normal, and least in the pre-normal group, and most conspicuous among the males. These facts stand out much more clearly in Graph XI.

6. Among the males the post-normal group decreased in size most rapidly, and the pre-normal group least rapidly, in passing from the freshman to the senior college years. This tendency indicates that elimination among the males was greater among the older entrants. The problems of elimination will be treated more at length in Section 2.

7. The males showed a larger proportion than did the females in both the pre-normal and post-normal entrance groups; which agrees with a previous statement to the effect that the males showed the greater variability in entrance-ages.

TABLE 20

*Comparative Scholarship, During Successive College Years, of Groups of Different Ages at Entrance Who Remained till Graduation*

Age at Entrance	Males					Females				
	Number of Students	Median Scholarship	Middle 50 percent		Range of Scholarship Values	Number of Students	Median Scholarship	Middle 50 percent		Range of Scholarship Values
			1st Quartile	3d Quartile				1st Quartile	3d Quartile	
Freshmen						Freshmen				
Pre-Normal	14	18.5	16	21.75	12 to 26	26	17	14.75	21	7 to 29
Normal	48	17	11	20	0 to 30	181	16	12	21.5	5 to 32
Post-Normal	19	15	11	21	-3 to 26	43	17	14	21	6 to 33
Sophomores						Sophomores				
Pre-Normal	14	18.5	15	22	11 to 25	26	21	15	26	2 to 32
Normal	48	17	12.25	22.25	6 to 37	181	17	14	24	4 to 36
Post-Normal	19	16	11	25	2 to 29	43	18	14	24	7 to 40
Juniors						Juniors				
Pre-Normal	14	20.5	18	23.5	10 to 29	26	21	16.5	26	6 to 37
Normal	48	19	14.25	26.75	-4 to 36	181	20	16	26	0 to 36
Post-Normal	19	18	12	26	0 to 35	43	21	16	25	8 to 34
Seniors						Seniors				
Pre-Normal	14	21.25	16.75	23	14.25 to 29	26	19.25	17.2	23	13.25 to 25.5
Normal	48	20.6	17.25	24.9	-10 to 37.5	181	20	17	23	-6 to 37
Post-Normal	19	18	13.5	20	-65 to 36	43	20.25	18	24	14 to 30



Let us now contrast Table 19 and Graph X with Table 20 and Graph XI. In the latter we have displayed the achievements for each college year of those males and females only who persisted in their work until the end of the fourth year. Table 19 and Graph X thus differ from Table 20 and Graph XI, in that the latter pair exclude all those student who were eliminated before the end of the fourth college year, while the former pair include them. The differences noted may thus be attributed to elimination.

Comparison of these graphs and tables brings out the following additional facts:

8. In both sexes, the increase in scholarship shown in passing from the freshman up through the senior college years, is due in large measure to the elimination of the poorest students during each successive year. This statement is confirmed by reference to Table 21 and Graph XII, in which are represented the median standings of the pupils eliminated from college during, or at the end of, each collegiate year.

9. Elimination on account of poor scholarship appears to have been most important as a factor among the post-normal entrants, and among the males.

10. A considerable proportion of the rise in scholarship to be noted from year to year, is apparently due to the fact that upper classmen received higher marks than lower classmen, even when the same individual students were concerned in each case.

11. Of the eliminated students, the females ranked generally higher in scholarship than did the males; but of the four-year students the males show practically equal achievement, except in the post-normal group.

## SECTION 2

### COMPARATIVE COLLEGE EFFICIENCY AS MEASURED BY RETENTION AND ELIMINATION

From Table 22 and Graph XIII, describing the number of semesters which the median and quartile students of each entrance group remained in college, we derive the following statements:

1. The females showed far less tendency than the males to be lost before the end of the college course.

TABLE 21

*Number of Students of Each Entrance Group Who were Eliminated During or at End of Each College Year and Their Median Scholarship*

College Year	Age at Entrance	Male		Female	
		Number of Students Eliminated	Median Scholarship	Number of Students Eliminated	Median Scholarship
Freshmen	Pre-Normal	7	0	7	8
	Normal	59	6	69	10
	Post-Normal	47	1.5	46	5
Sophomores	Pre-Normal	3	5	8	9
	Normal	45	8	41	13.5
	Post-Normal	26	6	17	21
Juniors	Pre-Normal	13	13.5	7	20
	Normal	20	14.75	35	18
	Post-Normal	13	14	10	14.75
Seniors	Pre-Normal	Not ascer	tained	Not ascer	tained
	Normal				
	Post-Normal				

TABLE 22

*Number of Semesters Which the Median Student, and the First and Third Quartile Students, of each entrance group, Remained in College.*

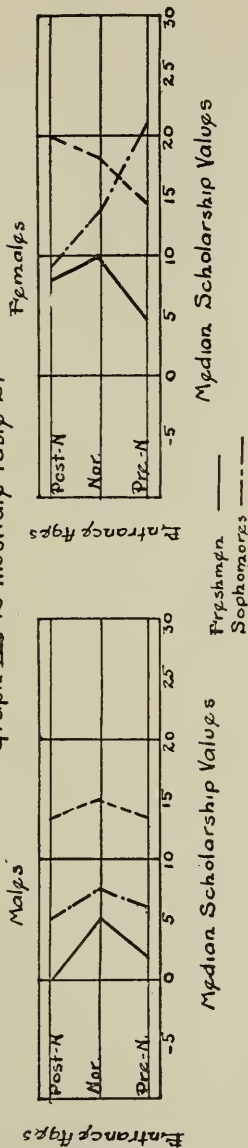
Age at Entrance	Males				Females		
	Semester Retention of Median Student	Semester Retention of Middle 50 percent		Semester Retention of Median Student	Semester Retention of Middle 50 percent		
		1st Quartile	3d Quartile		1st Quartile	3d Quartile	
Pre-Normal	5.5	4.25	8	8	4	8	
Normal	4	2	8	8	3	8	
Post-Normal	3	2	5.5	4	2	8	

2. In both sexes, the post-normal entrants showed the least degree of persistence; while with the males the pre-normal entrants showed the greatest.

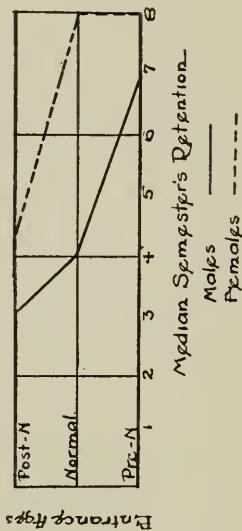
From inspection of Graph XIV, entitled "Percentages Eliminated Annually," we are able to add these facts:

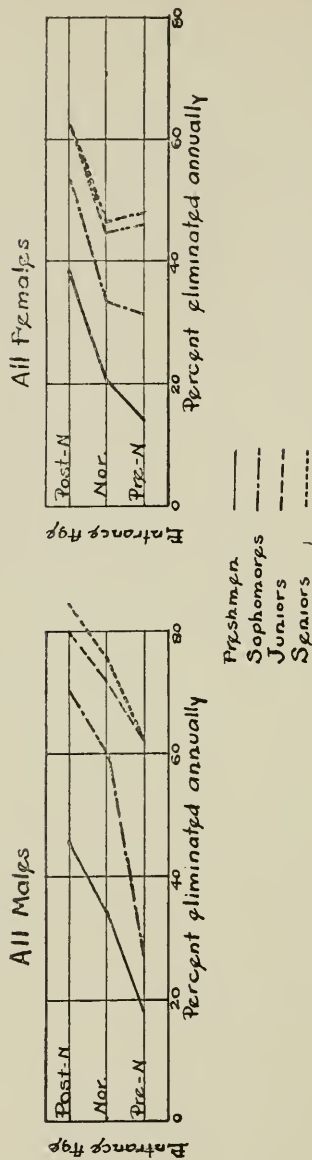
3. Among the normal and post-normal entrants, the greatest percentage of elimination occurred before the beginning of the sophomore year, the next greatest before the junior year, and the third greatest before the senior year; while by far the least dropping-out occurred during the senior year. This statement holds for both sexes. The pre-normals show some alteration of this order,

Graph XII to illustrate Table 2.1



Graph XIII to illustrate Table 2.2





GRAPH XIV.

PERCENTAGES OF THE PRE-NORMAL, NORMAL, AND POST-NORMAL ENTRANCE-GROUPS, OF BOTH SEXES, WHO WERE ELIMINATED DURING DIFFERENT COLLEGE YEARS.

but as this group was rather small numerically, it is not improbable that the order here is accidental.

4. The female normal entrance-group shows a slightly greater persistence than the pre-normal group, when thus subjected to a closer analysis. But the difference, while opposed to that found in the case of the males, is exceedingly small.

Returning now to Table 21 and Graph XII, which are concerned with the relation between elimination and scholarship, we find authority for adding the following to our catalogue of inferences:

5. The freshmen who were dropped displayed exceedingly poor scholarship, particularly the males; the sophomores who were dropped, while very low, did better work; the juniors who were eliminated were nearly the equals in scholarship of those who were retained. The number of students who were dropped during the senior year was too small to warrant continued comparison.

6. Poor scholarship was apparently a more consistent companion of elimination among those students who entered before and after normal age than among those who entered normally. The female sophomores and juniors show exception to this statement, but these are self-contradictory in their tendencies.

### SECTION 3

#### SUMMARY

That the principal tendencies displayed in this chapter are completely in harmony with those described in Chapter IV, may be shown by a few brief statements.

During the freshman and sophomore years, the pre-normal entrants showed the highest college efficiency and the post-normal entrants showed the lowest. Little difference was manifested between these groups during the junior, and particularly the senior, college years.

Poor scholarship eliminations were greatest in the post-normal group, and least in the normal group.

Teachers gave increasingly high marks to the same students during successive college years. For statistical reasons, owing to the elimination of the poorer students during the earlier years, one would expect the marks of the group which remained to decrease rather than to increase in median value as time went on.

## CHAPTER VI

### A PARTIAL EXPLANATION OF THE RELATIONS OBTAINING BETWEEN AGE AT ENTRANCE AND COLLEGE EFFICIENCY

We have now to seek an answer to one main question: Why were the pre-normal entrants superior, and the post-normal entrants inferior in college efficiency to the normal entrants?

The explanation which we shall advance starts from this hypothesis. The students who entered college before normal age consisted of those students who were graduated from the high school early because of superior ability, and who would be expected to display corresponding superiority in college. The post-normal entrants comprised at least two groups of students; first, those who were graduated late from the high school, in most cases because of lack of interest or ability; and second, those who were graduated from the high school on schedule time, but who permitted an interval of a year or more to elapse before entering college. The inferiority of the post-normal entrants was due to the first, and possibly to both, of these groups.

The present chapter is devoted to the demonstration and application of this hypothesis. Its demonstration necessitates a comparison between the work done, both in the high school and the college, by those students who came to college immediately from the high school and the work done by those who permitted an interval to intervene. We shall accordingly divide each of the three entering groups into four sections, consisting respectively of (1) those students who permitted an interval of time to elapse between high-school graduation and college entrance, (2) those who were graduated from the high school after normal age, but came immediately to college, (3) those who were graduated late from the high school, and entered college a year or more thereafter, and (4) those who did neither, but who, after having been graduated on time, entered college immediately thereafter.

## SECTION 1

NORMAL AND NON-NORMAL ENTRANCE-AGES AS RELATED TO IMMEDIACY  
OF COLLEGE ENTRANCE

Let us first note the comparative number of normal, pre-normal, and post-normal entrants who belong in each of these divisions.

TABLE 23

*Comparative Numbers of Students Entering College at Different Ages and at Different Periods After High-School Graduation.*

	Males						Females					
	Pre-Normal college entrants		Normal college entrants		Post-Normal college entrants		Pre-Normal college entrants		Normal college entrants		Post-Normal college entrants	
	No.	Per- cent	No.	Per- cent	No.	Per- cent	No.	Per- cent	No.	Per- cent	No.	Per- cent
1. With intervening period. . . . .	1	2.7	22	12.8	23	21.9	5	10.4	34	10.4	43	37.1
2. With late graduation. . . . .	..	..	..	..	58	55.2	..	..	..	..	42	36.2
3. With both. . . . .	..	..	..	..	7	6.7	..	..	..	..	18	15.5
4. With neither. . . . .	32	86.5	136	78.9	..	..	41	85.4	274	84.2	..	..
5. Unknown. . . . .	4	10.8	14	8.3	17	16.2	2	4.2	18	5.5	13	11.2

Certain features of this table might easily have been forecasted. No late graduates from the high school could be found among students who entered college at or before normal age, and none who was without either an intervening period or a late graduation could be found in the post-normal group. But the tables give us two new facts of considerable importance. Of the male post-normals, more were graduated from the high school late than entered college after a lapse of time, while of the female post-normals the reverse tends to be the case. Again, a larger proportion of the pre-normals than of the normals of both sexes, entered directly from a normal-age high-school graduation. It should also be noted that only six cases, in both sexes, of the pre-normals permitted a year of time to intervene before college entrance.

We pass next to the quality of scholarship displayed by each of these groups. This item was ascertained for the freshman year only—the year when differences in scholarship are most manifest and when all college entrants start in competition.

TABLE 24

*Quality of College Scholarship Displayed by Students Entering at Different Entrance Ages and at Different Periods after High-School Graduation*

	Pre-normal College Entrants		Normal College Entrants		Post-normal College Entrants	
	Me- dian schol- arship	Range of Middle 50 percent	Me- dian schol- arship	Range of Middle 50 percent	Me- dian schol- arship	Range of Middle 50 percent
<i>Males</i>						
1. With interven- ing period....	17	.....	13	8 to 19.5	16	9 to 20
2. With late graduation....	..	.....	..	.....	5.5	-1.25 to 13
3. With both....	..	.....	..	.....	7	-6 to 15
4. With neither..	16	9 to 21	11	5 to 18	..	.....
<i>Females</i>						
1. With interven- ing period....	18	10.5 to 23	15	10.75 to 23	16	12 to 21
2. With late graduation....	..	.....	..	.....	8.5	5 to 17
3. With both....	..	.....	..	.....	10.5	6 to 16.5
4. With neither..	16	11.5 to 19.5	15	10 to 20	..	.....

This table makes evident the following points:

1. Among the pre-normal entrants of both sexes, those pupils who waited a year or more after graduating from the high school before entering college, stood somewhat higher in their college work than did those who did not wait. Here we repeat that there were only six pre-normal entrants who permitted this delay.

2. The same fact appears among the males who entered at normal age. Among the female normal entrants, the two groups show the same median, but the range of the middle 50 percent is lower with those who entered college immediately, than with those who waited a year or longer. In these normal-entrance groups, the number of cases is sufficiently large to give significance to the results.



3. The point which we would especially emphasize in connection with our present problem, is found on inspection of the post-normal-entrance groups. Here we find that those students who were graduated from the high school late, and who for this reason were late entrants at college, stood lower than did those who were graduated from the high school on schedule time but who waited a year or longer before entering college. Those who were graduated late, and also permitted an intervening period, stood between the groups just described.

4. The post-normal entrants, who entered college a year or more after graduation, are evidently not responsible for the general inferiority manifested by this group, since in both sexes their median rank is above the median ranks of the total post-normal and normal groups.

These three results are rather generally confirmed when one applies the second of our criteria of efficiency, *i. e.*, retention. The post-normal entrants showed the following median semesters retention: males, with intervals, 5.75 semesters; males, with late graduation, 3 semesters; females, with intervals, 8 semesters; females, with late graduation, 5 semesters. The pre-normal females showed a better retention for those who entered immediately than for those who waited, but the pre-normal males who entered after a wait remained for college graduation. In the normal entrance-age group the regular entrants and those who delayed before entrance show the same median, and the same inter-quartile range.

These results substantiate that portion of our hypothesis which relates to the deficiency characterizing the post-normal entrants. These are demonstrated to consist of the two types of students assumed in the hypothesis, plus a third type in which both departures from normal entrance conditions are combined. Of these, students of the type entering college late because they were graduated from the high school behind schedule, are shown to be responsible for the deficiencies described.

It remains to prove that the pre-normal entrants did work in the high school superior to that done by the normal and post-normal entrants, and were thus a positively selected group; while the post-normal entrants who were graduated late from the high

school did inferior work there, and consequently were a negatively selected group. For this purpose we turn to the high-school records of the different groups of students.

## SECTION 2

### AGE AND IMMEDIACY OF COLLEGE ENTRANCE AS RELATED TO HIGH-SCHOOL SCHOLARSHIP

We are able in this connection to present the high-school records for only 285 of the 828 college entrants considered, but to secure even these the records of 3644 high-school seniors were examined. We can, however, state the scholarship position among his high-school classmates occupied by each of the 285 college entrants. To determine this position, the students of each high-school graduating class sending members to college were ranked in order of scholarship from highest to lowest, and divided into five equal groups, or quintiles. In the table accompanying this section (Table 25), this quintile position is stated for the median pupil, and for the first- and third-quartile pupils, of each of the groups entering college under the conditions described in Section 1. As the best of these quintiles was numbered 1 and the poorest was numbered 5, *the smaller the figure representing the median scholarship of each group, the better the scholarship rank.*

Table 25 affords the additional facts necessary to complete the demonstration of our hypothesis. The following statements are based upon it:

1. The pre-normal college entrants are seen to have ranked notably higher in high-school scholarship than the normal and post-normal entrants. This fact confirms our original assumption that they were a positively selected group.

2. All of the post-normal female entrants ranked lower in the high school than the normal and pre-normal entrants. They were thus all a negatively selected group. The two chief types of post-normal male entrants, the late graduates and those entering after a lapsed interval, showed a difference in high-school rank in favor of the latter. No difference of this kind is noticeable in the case of the females. These facts confirm our original assumption that the

TABLE 25

*High-School Scholarship (in Terms of Quintile Distribution) of 285 High-School Graduates Entering College at Different Ages and at Different Periods after High School Graduation*

	Pre-normal College Entrants		Normal College Entrants		Post-normal College Entrants	
	Me- dian schol- arship	Range of Middle 50 percent	Me- dian schol- arship	Range of Middle 50 percent	Me- dian schol- arship	Range of Middle 50 percent
<i>Males</i>						
1. With interven- ing period....	..	.....	4.3	1.5 to 5	2	2 to 4
2. With late graduation.....	..	.....	..	.....	3.2	1.5 to 3.8
3. With both....	..	.....	..	.....	2.5	2 to 3.25
4. With neither..	2.7	1.7 to 4	3.1	1.7 to 4.4	..	.....
<i>Females</i>						
1. With interven- ing period....	3	.....	2.5	1.6 to 3.7	2.7	2 to 4
2. With late graduation.....	..	.....	..	.....	2.7	2 to 4.3
3. With both....	..	.....	..	.....	3	.....
4. With neither..	1.9	1.5 to 3.7	2.1	1.8 to 3.1	..	.....

post-normal entrants who were graduated from the high school late were a negatively selected group.

3. It should also be remarked that, in general, those students who entered college after a lapse of time, came from a poorer type of high-school graduates than did those who entered immediately after graduation. We have already seen (Table 24) that these elapsed-interval students did a better grade of work in college. These facts suggest that such an interval contributed to better college work. However, as the students in the two cases are not absolutely identical,—the earlier tables including many not included in the last—we must await the results disclosed in the next section.

### SECTION 3

#### COMPARISON OF THE ACHIEVEMENTS OF IDENTICAL STUDENTS IN THE HIGH SCHOOL AND COLLEGE

Thus far we have seen (1) that the pre-normal college entrants did a better grade of work, both in the high school and college, than

the normal and post-normal entrants; and (2) that the post-normal college entrants who had been graduated late from the high school, shower inferior scholarship, both in college and high school. In other words, the college superiority of the pre-normal entrants and the college inferiority of the post-normal entrants, is due to the type of high-school student mainly selected by each group. But there is one defect in our proof thus far; the students for whom the high-school records are given constitute only a portion of those for whom the college records are given. In the following table, therefore, is stated the collegiate scholarship of identically the same students as those whose high-school scholarship is presented in Table 25.

TABLE 26

*College Scholarship of 285 High-School Graduates Entering College at Different Ages and at Different Periods after High-School Graduation*

	Pre-normal College Entrants		Normal College Entrants		Post-normal College Entrants	
	Me- dian schol- arship	Range of Middle 50 percent	Me- dian schol- arship	Range of Middle 50 percent	Me- dian schol- arship	Range of Middle 50 percent
<i>Males</i>						
1. With interven- ing period....	..	.....	16	3 to 17	12	10 to 19
2. With late graduation....	..	.....	..	.....	5.5	-6 to 14.75
3. With both....	..	.....	..	.....	8.5	.....
4. With neither..	11	7 to 18	10	4 to 17	..	.....
<i>Females</i>						
1. With interven- ing period....	10	.....	16	12.5 to 24.25	14	11.5 to 19
2. With late graduation....	..	.....	..	.....	7	5 to 14.5
3. With both....	..	.....	..	.....	14	.....
4. With neither..	14	8 to 17.75	14	9 to 18	..	.....

Comparison of this table with Table 24 shows that it reveals practically the same tendencies, and warrants the statement that the high-school records displayed in Table 25 are representative, even if incomplete.

## SECTION 4

## CONCLUSIONS

The main conclusions which we would state once more are these: First, students who entered the college at ages younger than normal entrance age stood higher and remained longer, upon the whole than those who entered normally or older. Second, students who entered at older than normal ages, stood lower and remained for a shorter period than those who entered at normal age or younger. Third, the 18-year-old normal entrants outstayed and outranked the 19-year-old normal entrants, and there is evidence that the post-normals who entered after 22 or 23 were somewhat more efficient than the younger entrants of the same group.

Do these statements mean that pressure should be exerted to force all prospective students into college before they are 18 years of age? Ought what we have described as 'pre-normal' to become the 'normal' entrance ages? Such a conclusion would be most ill-advised. Complete investigation shows that those students who entered college before 18 years of age were a selected group, who had finished the high school before the majority of their fellows because of superior ability, and who, accordingly, would be expected to surpass them in college. Owing to the high correlation shown to obtain between retention and good scholarship, they would also be expected to show greater persistence. A majority of the post-normal entrants, on the other hand, are shown to have been poor students in the high school, and for this reason to have been graduated therefrom at a comparatively late age. These students naturally would be slow and uncertain quantities in college. Selection, not age, is the real key to the situation.

But if the demonstrated superiority of the early over the late entrants cannot be urged as an argument that all students should enter college before 18, cannot the inferiority of the late entrants at least be urged to prevent those seemingly waste intervals which students often permit to elapse between high-school graduation and the taking up of college work? Here, again, our answer must be negative. The inferiority of these late entrants was clearly due to the poor students who made up a large part of the group, and not

intrinsically to age. Furthermore, in the normal entrance group those students who entered college a year or more after high-school graduation generally outranked those who entered immediately, in spite of the fact that they were apparently inferior students in the high school. Here the interval seemed in reality to contribute to college efficiency.

The second conclusion of general interest which we wish again to emphasize, relates to the better standard of scholarship displayed in passing from the first to the last college year. Two causes of this elevation in standards are clearly indicated. The first and most effective is the elimination of inefficient students, particularly during the first two college years. But the second, to which we would call particular attention, is the actually increasing generosity of teachers in the distribution of high marks, clearly shown by the fact that the same group of students received higher and higher grades from year to year. This fact is important as it indicates that the standard of work required during the successive college years did not rise in proportion to the rise in student ability. A proportional rise of this sort has been assumed, by those who advocate the normal curve as the criterion of a proper distribution of marks.

There is yet a third conclusion to which the reader's attention may profitably return. Several students of the problem of marking have shown that, in both the elementary and the high school, female pupils received higher marks than male pupils. Our data show that the same relations exist in college. But when we consider separately the males and females who spent four full years at college work, we discover that the difference has practically disappeared.

Two facts thus demand interpretation. As to the first, that, in general, the males received lower marks than the females, here, as in the earlier studies, we must beware of an interpretation which consigns either sex to the limbo of inferior ability. Doubtless several factors cooperate to produce this consistently appearing relation, and possibly not least among them is the better adaptation of our entire school system, from top to bottom, to the peculiar interests and abilities of the female sex. But upon this important question of causes our study throws no light, and we must content ourselves

with the mere confirmation of results already sufficiently proved by others.

The second fact, that the continuous four-year students of the two sexes showed practically equal efficiency, has not previously come to the writer's notice. Its full significance is not clear, but it possibly is no more than an indication that elimination had successfully removed the misfits of both sexes, and had left chiefly those who were peculiarly adapted to college life. These students were in all probability too much the product of an artificial selection to be representative of the usual abilities or achievements of either sex.

## CHAPTER VII

### SIZE OF HIGH SCHOOL AS RELATED TO EFFICIENCY IN COLLEGE

Is there any consistent relation between the number of pupils enrolled in the different high schools tributary to the university under discussion and the scholarship and persistence shown in college by their graduates?

The methods used in attempting to reach a solution of this problem, are fundamentally like those followed in the study of entrance ages. The main difference is that size of high school, rather than age at entrance, is used to determine membership in the student groups whose college efficiency is to be compared. There are six of these groups of public-school graduates, consisting respectively of those representing high schools with enrolments of (1) 100 pupils or less, (2) 101 to 200 pupils, (3) 201 to 300 pupils, (4) 301 to 500 pupils, (5) 501 to 1000 pupils, and (6) more than 1000 pupils. This grouping was borrowed from Counts<sup>1</sup> and from Jessup and Coffman<sup>2</sup> in order that our results might be made comparable with theirs. To these six groups we have added two others, not included in the earlier studies, consisting of the graduates of (7) military and (8) private schools, including schools maintained by religious orders.

#### SECTION 1

##### SIZE OF HIGH SCHOOL AS RELATED TO COLLEGE SCHOLARSHIP

The relation between size of high school and the college scholarship of high-school graduates, is shown in Tables 27 and 28. And Graph XV. These tables and this graph are formulated according to the plan already employed in Chapter IV, and should be interpreted similarly. They warrant these conclusions:

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<sup>1</sup>Judd, C. H., and Counts, G. S. Study of the Colleges and High Schools of the North Central Association. *Bulletin Bureau of Education*, 1915. No. 6.

<sup>2</sup>Jessup, W. A. and Coffman, L. D. North Central High Schools. *13th Year-Book of This Society*, 1914, pp. 73-115.



TABLE 27  
College Scholarship of Male Graduates of Military, Private, and Public Schools of Different Enrolments

Type and Size of School	Freshmen					Sophomores					Range of Scholarship Values
	Number of Schools	Number of Students	Median Scholarship	Middle 50 Percent		Number of Schools	Number of Students	Median Scholarship	Middle 50 Percent		
				1st Quartile	3d Quartile				1st Quartile	3d Quartile	
1-100	39	59	10	4	14	26	32	11.5	8	17.5	- 8 to 28
101-200	37	51	11	5	18	26	38	12	8	20	- 8 to 27
201-300	12	21	12	9	17.5	11	15	14	10	19	-10 to 29
301-500	7	30	11.5	6.25	17.25	4	20	14.5	8.75	18.25	- 6 to 28
501-1000	7	23	13	4	17	3	15	12	6	22	- 2 to 27
1001+	5	82	13	2.75	20	5	56	14.5	7.5	21	- 8 to 37
Private	13	22	7.5	-2.5	18	12	16	9.5	4.5	17.5	- 6 to 26
Military	3	8	1	-5	5	2	4	5	.....	.....	- 2 to 19
Juniors											
1-100	16	20	18	9	21.25	8	8	20	12.4	24.75	- 1 to 27
101-200	18	22	19	15.7	24	10	10	20	15	24	0.5 to 30
201-300	7	8	15	10.75	24	4	4	21.9	.....	.....	18 to 36
301-500	4	14	15.5	14	21.75	2	10	21.5	16.9	24.6	16 to 36
501-1000	3	8	19.5	8.5	29.75	2	7	23	15	25	-10 to 37
1001+	5	39	20	14	27	5	28	19.25	17.25	24.3	- 6 to 38
Private	10	10	18.5	11.75	26.5	8	8	18.5	14.7	28.3	14 to 32
Military	2	2	11	.....	.....	2	1	11	.....	.....	.....
Seniors											

TABLE 28  
College Scholarship of Female Graduates of Private Schools and of Public Schools of Different Enrolments

Type and Size of School	Freshmen						Sophomores						
	Number of Schools	Number of Students	Median Scholarship	Middle 50 Percent			Number of Schools	Number of Students	Median Scholarship	Middle 50 Percent			Range of Scholarship Values
				1st Quartile	3d Quartile	Range of Scholarship Values				1st Quartile	3d Quartile	Range of Scholarship Values	
1-100	42	58	13.5	8	17	-8 to 29	33	46	15.5	10	21	3 to 36	
101-200	36	62	14	7	18	-6 to 28	29	47	16	12	23	-6 to 35	
201-300	15	29	16	12.5	20.5	4 to 25	11	23	16	13	23	6 to 30	
301-500	12	53	16	10.5	19.5	-2 to 31	11	45	18	14	25	4 to 33	
501-1000	8	18	18.5	14	21.25	6 to 25	6	16	21	12.5	26.75	2 to 32	
1001+	5	208	16	10	21	-6 to 33	5	156	19	13	23	-8 to 40	
Private	8	32	11	1	17.75	-8 to 29	11	16	17	14	25	2 to 31	
										Seniors			
1-100	26	35	19	14	23	0 to 30	22	28	20	17.25	26.25	10 to 37	
101-200	28	40	20.5	16.5	26	8 to 34	25	37	21	18.75	22.75	6 to 27	
201-300	10	17	19	15.1	21.5	10 to 26	8	13	18.75	17.5	20.5	0 to 26	
301-500	11	37	23	19.5	26.5	9 to 37	10	34	20	16.75	23.1	-6 to 35	
501-1000	6	13	22	19	27	14 to 30	6	12	20.75	19.2	22.75	15 to 32	
1001+	5	130	19.5	15	26	0 to 36	5	194	19.5	17.25	23.2	12 to 37	
Private	9	13	18	12.5	25	10 to 36	7	9	20.25	13.5	24	11 to 25	
										Juniors			

1. In the case of males, military-school graduates show in the freshman year the poorest general scholarship in college, private-school graduates come next, and the college scholarship of public-school graduates is generally higher in the product of the larger than of the smaller schools.

2. The same general tendency appears among the females, except that a deficiency is noticed in the graduates of schools enrolling more than 1000 pupils. The probable explanation is that, as all of the schools of this size were local (Minneapolis schools), a larger proportion of all their female graduates, and hence of their inferior female graduates, entered the university. A corresponding decline of the college scholarship curve would be expected.

3. In both sexes the above described tendencies are largely lacking in the last two college years, when the curves show great irregularity. This change is clearly due to elimination, which factor will next be described. Meanwhile, the reader must bear in mind that freshman scholarship alone bears directly upon our problem.

SECTION 2

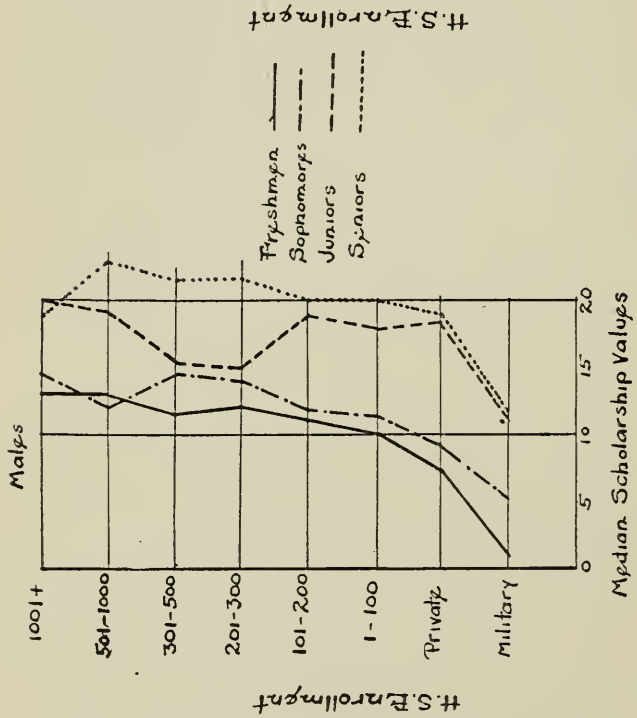
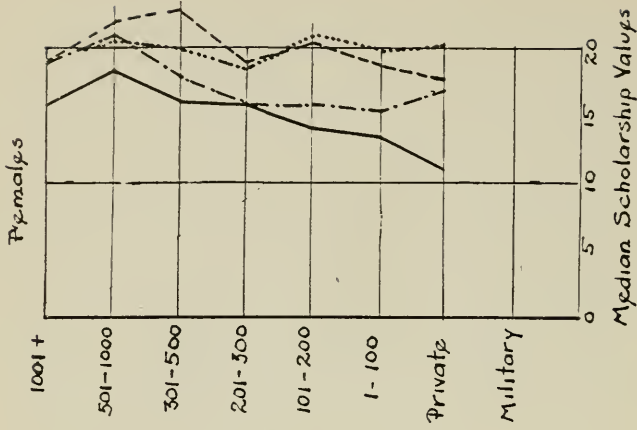
SIZE OF HIGH SCHOOL AS RELATED TO COLLEGE RETENTION.

Table 29 shows the percentages of college students entering from high schools of different enrolments who were retained from year to year. These data appear again in Graph XVI.

TABLE 29

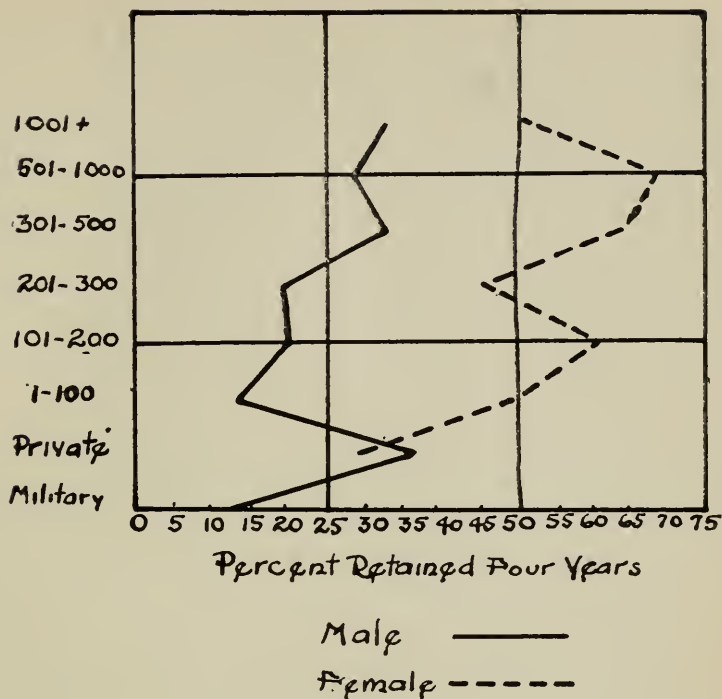
*Retention in Percentages of Students Entering College from Military and Private Schools, and from Public Schools of Different Enrolments*

Type and Size of School	Males			Females		
	Percent Retained as Sophomores	Percent Retained as Juniors	Percent Retained as Seniors	Percent Retained as Sophomores	Percent Retained as Juniors	Percent Retained as Seniors
1-100	54.3	33.9	13.6	79.3	60.3	48.3
101-200	74.5	43.1	19.6	75.8	64.5	59.7
201-300	71.4	38.1	19.0	79.3	58.6	44.8
301-500						
501-1000	65.2	34.7	30.4	88.9	72.2	66.7
1001+	68.3	47.6	34.1	75.0	62.5	50.0
Private	72.7	45.4	36.4	50.0	40.6	28.1
Military	50.0	25.0	12.5	...	...	...



GRAPH XV.

COMPARATIVE SCHOLARSHIP OF STUDENTS ENTERING FROM MILITARY AND PRIVATE SCHOOLS AND FROM PUBLIC HIGH SCHOOLS OF DIFFERENT ENROLLMENTS.



GRAPH XVI.

COMPARATIVE COLLEGE RETENTION OF STUDENTS ENTERING FROM MILITARY AND PRIVATE SCHOOLS AND FROM PUBLIC HIGH SCHOOLS OF DIFFERENT ENROLMENTS.

1. For the males the private schools showed the largest retention of students to the fourth college year. This persistence is surprising in view of the fact that graduates of these schools showed inferior scholarship in college. However, the military-school graduates showed the smallest percentage of retention, as well as the lowest scholarship; while of the public-school graduates, those from the larger schools showed a higher retention than did those from the smaller schools.

2. For the females the private-school graduates showed the smallest percentage of retention. Public-school graduates showed

in general the tendency just described for the males, but less consistently. Notable exceptions are seen in the groups representing school populations of 201 to 300 and of "over 1000." Reference to Graph XV recalls the fact that these groups were also deficient in scholarship. The deficiency in the "more than 1000" group has been accounted for, but the cause of the deficiency, both in scholarship and retention, in the 201 to 300 pupil group is obscure.

While there are obvious discrepancies in both sex-curves, probably owing to insufficient cases, the net result agrees with the principle already advanced that inferior scholarship is closely correlated with low retention and high elimination.

### SECTION 3

#### SIZE OF HIGH SCHOOL AS RELATED TO HIGH-SCHOOL SCHOLARSHIP.

The evidence which has been advanced shows quite clearly that public-school graduates showed greater efficiency in college than did the military- and private-school product, and that the graduates of the larger schools did better work than the graduates of the smaller schools.

A new problem now confronts us. Was the greater college efficiency of the graduates of some schools due to an actual superiority of those schools as college-preparatory institutions, or can the phenomena be accounted for as the outcome of selection? It is possible that the students representing the larger public schools were among the best products of those schools, while the smaller public school, and the private and military schools, were represented more largely by their inferior product.

A clear solution of this issue can come only from a study of the high-school rankings of the graduates of the respective schools. As much of such a study as it is possible for us to make appears in Table 30. Unfortunately, the number of students for whom these records were obtained is small as compared with the total number of college students. For this reason, Table 31 is introduced, to portray the college scholarship of the same students whose high-school ranking is set forth in Table 30.

Table 30 corresponds to Table 25 in Chapter VI. Here as there, and for the same reason, *the smaller the rank value* appearing

in the columns for the median and the first and third quartile pupils, *the better the scholarship rank.*

Inspection of Tables 30 and 31 furnishes no conclusive answer to our question. It is clear that while the private schools were represented by their best product, their graduates did very inferior work in college. Private schools seem, therefore, to be inferior to public schools as college-preparatory institutions.

But the different groups of public-school graduates show no clear tendencies. An insufficient number of cases is the probable cause. In general, it appears that the larger schools sent a slightly better grade of their students to college than did the smaller schools. If this be correct, then the college superiority of the larger-school graduates may be due partly or wholly to this selection, and not to the inferior efficiency of the smaller schools. However, the tendencies here displayed are not consistent, and the data are clearly insufficient. The writer accordingly lays no stress upon these tables.

#### SECTION 4

##### SIZE OF CLASS IN HIGH SCHOOL AS RELATED TO COLLEGE EFFICIENCY

It is popularly supposed that size of class is a matter of considerable importance in determining the quality of school instruction. We have therefore sought to discover any relationship which might obtain between size of class in high school and the later college work of high-school graduates.

The same problem has been attacked from a different angle by several writers.

Cornman<sup>3</sup> in 1909, reached the conclusion that the size of the recitation group was not an important factor in deportment nor in the quality of the daily work. Bachman<sup>4</sup> and Boyer<sup>5</sup> agree that large classes did not affect the promotion rate to any noticeable degree.

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<sup>3</sup>Cornman, O. P. Effect of size of class on school progress. *Psychological Clinic*, Dec., 1909.

<sup>4</sup>Bachman, F. P. *Report of N. Y. Committee on School Inquiry*, Vol. I, Part II.

<sup>5</sup>Boyer, P. A. Size of class and promotion rate. *Psychological Clinic*, May, 1914.

Rice<sup>6</sup> reached the conclusion that "large classes ranked high as often as small classes when tested for arithmetical abilities." In a recent study embracing 1348 classes and 35,573 pupils, Harlan<sup>7</sup> comes to the following conclusions:

"(1) The effect of the size of the class on promotion rate, though slight, is in favor of 30 pupils or less.

"(2) Large classes seem to be a factor in producing withdrawals.....

"(3) Medium sized classes (30 to 45 pupils) seem to do better work in arithmetic than either very large or very small classes.

"(4) The opportunity of the pupils to participate in the work of the recitation is somewhat more limited in large than in small classes.

"(5) In the results obtained from the data at hand the efficiency of large classes over that of small classes is not apparent when measured by the attention given during the recitation, by the time spent in routine activities of the classroom, and by the time wasted in the study period.

"In the light of these conclusions the class of median size (23 pupils) seems too small for the most economical administration of our schools. Small classes are expensive since they increase the cost per pupil. This added expense does not seem justified..... If one wishes to secure higher promotion rates, higher scores in arithmetic, better attention and wider participation in class work, more efficient class management and better study habits, these things can undoubtedly be secured through improved methods of instruction and more efficient supervision of the larger classes rather than through a reduction in the size of class."

It is almost axiomatic to say that a very high correlation exists between the number of pupils per teacher in any school and the general size of the classes in that school. If evidence be regarded as essential upon this matter, it may be found in the bulletin by Counts to which we have several times referred. We are able to present a grouping of the graduates of the various high schools involved in this study in terms of the number of pupils per teacher in each school. Five classes have thus been formed, consisting of the representatives of (1) schools enrolling 15 or fewer pupils per teacher, (2) schools with from 16 to 20 pupils, (3) those with from 21 to 25 pupils, (4) those with from 26 to 30 pupils, and (5) schools with more than 30 pupils per teacher. The last group was not further divided, because there were few representatives from schools with more than 35 pupils per teacher, and nearly all of these were in one school in which the number per teacher was 36.

<sup>6</sup>Rice, J. M. *Scientific Management in Education*. Chapter IV.

<sup>7</sup>Harlan, Chas. L. Size of class as a factor in schoolroom efficiency. *Educational Administration and Supervision*, March, 1915.



TABLE 30

Comparative High School Scholarship, in Terms of the Quartile Position of the Median, and the First and Third Quartile Students, of Students from High Schools of Different Sizes and Types. (The smaller the figure representing scholarship, the higher the scholarship rank.)

High School Enrollment	Males					Females				
	Number of Students	Median Scholarship	Middle 50 Percent			Number of Students	Median Scholarship	Middle 50 Percent		
			1st Quartile	3d Quartile	3d Quartile			1st Quartile	3d Quartile	
1-100	33	3.6	1.8	4.9	39	2.8	1.9	3.6		
101-200	49	3.2	1.7	4.4	45	2.8	1.8	4.1		
201-300	14	2.3	1.9	4.1	18	3.6	2.25	4.6		
301-500	3	2.0	..	..	6	1.75	1.4	4.25		
501-1000	..	..	..	..	..	..	..	..		
1001+	21	3.0	1.6	3.9	47	2.8	2.0	3.8		
Private	2	1.5	..	..	9	2.0	1.5	5.25		

TABLE 31

College Scholarship of Those College Entrants Whose High-School Scholarship is Known

High School Enrollment	Males					Females					
	Number of Students	Median Scholarship	Middle 50 Percent			Number of Students	Median Scholarship	Middle 50 Percent			Range of Scholarship Value
			1st Quartile	3d Quartile	3d Quartile			1st Quartile	3d Quartile		
1-100	33	9	0	15.5	39	13	7	19	-6 to 26		
101-200	49	11	4.5	17	45	14	8	17.5	-6 to 28		
201-300	14	11	1.75	17	18	16.5	14	19.5	6 to 26		
301-500	3	16	..	..	6	16	9.25	21.75	1 to 27		
501-1000	..	..	..	..	..	..	..	..	..		
1001+	21	15	5	19.5	47	15	9	18	-6 to 30		
Private	2	9.5	..	..	9	12	5	15.5	-4 to 18		

In studying the effect of class-size it is necessary to exclude the factor of size of school. Counts and others have shown that large schools generally mean large classes, and it is clear from earlier sections of this chapter that the product of the larger schools shows the greater college efficiency. The presence of this factor, therefore, would tell for the superiority of large classes.

This disturbing factor can be practically eliminated by retaining the six groupings of schools already made upon the basis of

TABLE 32

*Relation between Scholarship of College Students and the Number of Pupils per Teacher in the High Schools from Which They Come Both Sexes Combined.*

High School Enrolment	Pupils per Teacher	Number of Students	Median Scholarship	Middle 50 Percent		Range of Scholarship Values
				1st Quartile	3d Quartile	
1-100	1-15	29	11	5.0	18.0	-8 to 29
	16-20	23	11	6.0	15.0	-8 to 28
	21-25	38	10.5	7.7	14.0	-8 to 29
	26-30	17	11	4.5	16.0	-8 to 19
	31+	8	14.5	8.5	21.3	8 to 26
101-200	1-15	9	13	7.0	22.5	6 to 27
	16-20	32	11	6.3	18.0	-10 to 28
	21-25	39	11	7.0	16.0	-6 to 27
	26-30	23	15	4.0	18.0	-6 to 28
	31+	11	12	6.0	15.0	-2 to 20
201-300	1-15	..	..	..	...	.....
	16-20	1	-2	..	...	.....
	21-25	21	12	8.0	15.5	-6 to 22
	26-30	18	17	11.3	19.3	4 to 25
	31+	8	16	14.3	24.5	11 to 25
301-500	1-15	..	..	..	...	.....
	16-20	3	9	..	...	7 to 20
	21-25	65	16	9.0	18.5	-2 to 30
	26-30	9	15	5.5	16.0	-6 to 20
	31+	2	13	...	...	11 to 15
501-1000	1-15	..	..	...	...	.....
	16-20	1	-5	...	...	12 to 20
	21-25	2	16	...	...	-6 to 25
	26-30	24	14.5	8.8	19.8	10 to 14
	31+	2	12	...	...	.....
1000+	1-15	..	..	...	...	.....
	16-20	..	..	...	...	.....
	21-25	..	..	...	...	.....
	26-30	7	21	8.0	28.0	-2 to 28
	31+	282	15	8.5	20.0	-8 to 32

enrolment, and by then dividing each of these groups into five smaller groups according to the number of pupils per teacher. This procedure yields Table 32, which is self-explanatory.

The table shows a few consistent tendencies. The "26 to 30 pupils-per-teacher" group seems generally to lead the others, with occasional exceptions in favor of the "21 to 25" and the "31-plus" groups. In general, the schools with more than 20 pupils per teacher, and less than 31, lead those with 20 or fewer, and with more than 31. It seems safe to say, therefore, that high-school graduates coming from schools enrolling more than 20 and fewer than 31 pupils per teacher do a better grade of work in college, than those coming from schools with smaller or larger classes, irrespective of the total enrolment of the schools.

One other conclusion follows from inspection of the table. Schools enrolling fewer than 200 pupils show a greater range in the number of pupils per teacher, than do the schools enrolling more than that number. In general, also, the smaller schools are marked by smaller classes, and the larger schools by larger classes—a result which corroborates the findings of other workers.

#### SECTION 4

##### SUMMARY

1. Graduates of military and private schools show a college efficiency inferior to that displayed by public-school graduates.

2. Among public-school graduates, the better marks and the greater retention are found in the product of the larger schools.

3. The inferiority in college of the private-school graduates is clearly due to the inferiority of the private school as a college-preparatory institution.

4. So far as our data go, the superiority shown in college by the graduates of the larger over those of the smaller schools, may or may not be due to the superiority of the larger schools as college preparatory institutions. At present we can only conclude that, whatever the reason, graduates of the larger high schools may be expected slightly to surpass the graduates of the smaller high schools, when both reach college.

5. Irrespective of the total enrolment, graduates of high schools enrolling more than 20 and fewer than 31 pupils per teacher earn better marks in college than the graduates of schools enrolling 20 pupils or less, or more than 30 pupils per teacher. Within the limits of the study, therefore, the evidence favors the product of classes ranging from 21 to 30 pupils.

## CHAPTER VIII

### GENERAL SUMMARY

The following statements are fairly derived from the evidence which has preceded.

1. High-school graduates who entered college before 18 years of age did better work and remained longer in school than those who entered at 18 or later. Graduates who entered after 19 years of age did poorer work and left school earlier than did those who entered at 19 or younger. There were, of course, numerous individual exceptions to both statements.

These statements do not mean that all high-school students should be hurried into college before 18 or, at the latest, 20 years of age. The superior college efficiency of the younger entrants was correlated with their superior efficiency in the high school, which was responsible for their early graduation therefrom, and early entry into college. Conversely, the college inferiority of the late entrants was correlated with late graduation from high school, because of the inefficiency which they showed there. All that can be said with confidence as a result of this investigation, is that the college may expect in general that its younger entrants will stay longer than its older entrants and will do a superior grade of work.

2. Graduates of public schools did better work in college than graduates of military, private, and church schools. In general, they also tended to remain longer. Private and church schools were clearly inferior to public schools as college-preparatory institutions.

3. Graduates of the large public schools, speaking in terms of enrolment, showed greater college efficiency, both in marks and retention, than did graduates of the smaller public schools. It is not clear to what extent selection was responsible for this difference, nor, on the other hand, to what extent the larger schools were the better preparatory institutions. In general, the larger the schools the greater was the college efficiency of its graduates; this seems to have been the rule.

4. Schools enrolling from 21 to 30 pupils per teacher seemed to produce better college students than schools with fewer or with more pupils per teacher. This result is somewhat different from that reached by other students of the same problem, who found either no difference whatever in the efficiency of classes of different size, or a difference favoring classes of about 30. It should be noted that the present study has eliminated the factor of size of school, which, because large schools mean large classes, and because large schools mean greater efficiency, is a factor tending to distort the value of large classes.

5. The superiority of the female entrants over the males, in both scholarship and retention, appears throughout the study. The students of the two sexes who finished the college course, however, showed little difference in scholarship at any point.

6. The teachers of the advanced college classes of the junior and senior years gave better marks than were given by the teachers in the freshman and sophomore years to the very same pupils. Statistically, these pupils should, if anything, have received lower marks on the average during the later years, owing to the elimination of poor students during the first two years. It is clear that scholarship standards did not rise proportionally with the increase in student ability through elimination. Such a rise in standards is assumed to obtain by those who advocate the distribution of marks according to the normal curve throughout the college course.

7. There is some evidence, though insufficient for anything approaching conclusive proof, that the lapse of an interval of a year or more between high-school graduation and college entrance contributed to greater efficiency when college was once entered.

8. Elimination from college was highly qualitative; the good students tended to remain and the poor ones to go. This qualitative elimination was greatest in the freshman year, less but still important in the sophomore year, and insignificant in the junior and senior years.









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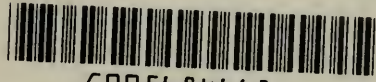
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